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American Machinist

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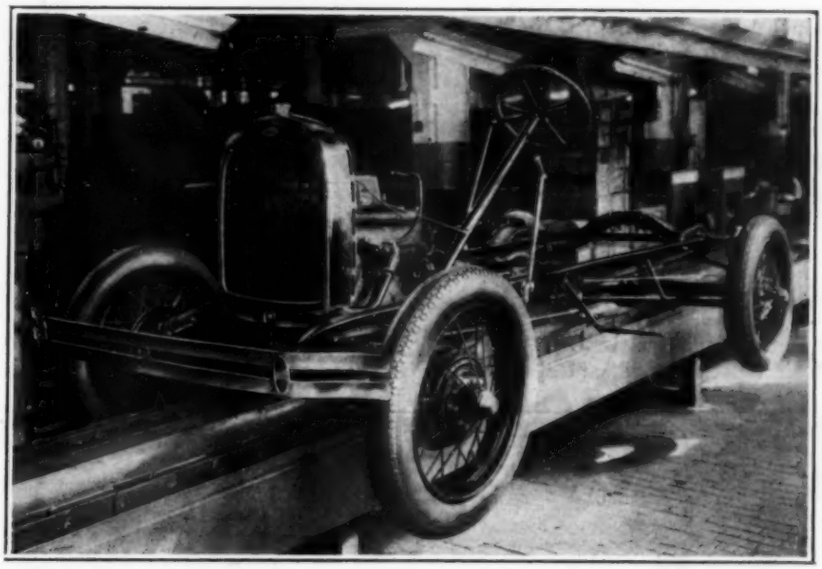
Volume 68 | New York, April 19, 1928 | Number 16



Preparing for Ford Production

By Fay Leone Faurote, M.E.

THERE are 53,000 machine tools in the Ford Motor Company shops today. A year ago there were only 43,000. When on May 26, 1927, the fifteen millionth Model T Ford left the process line and the great shop overhaul began, $4,868,427,012 had been expended for material during the previous nineteen years production (1908-1927), and a total for salaries and wages amounting to $1,970,414,972.29.

At the height of his production in 1921, Ford was making 56 per cent of all cars turned out by the industry. The common impression outside of Detroit was that the Ford Motor Company had shut down and that there was little business coming in. As a matter of fact, I was told that even during this so-called inactive production period orders amounting to $10,000,000 a month for Model T parts were filled. Even now approximately one eighth of the plant capacity in Detroit is being devoted to the making of parts for the older model, so that the 10,000,000 still on the roads may be serviced and kept running as long as their owners wish to use them.

With the advent of the new car a gigantic task was undertaken, perhaps larger than has ever been witnessed in any other industrial organization of this age. The first Model A motor was completed October 20, 1927, and the new Model A was publicly shown on December 2nd, 1927. At the end of January production had again reached about 1,000 per day despite the fact that a total shop overhaul had been necessary. Production schedules call for 4,000 a day on June 1st, and 5,000 per day by July 1st, 1928. A 6,000 car per day rate is planned. The shop equipment is nearly all

> Production plans call for 6,000 cars per day. The shop equipment is nearly all in place now. In the change-over $4,000,000 was spent for new machine tools, $4,500,000 for altering tools on hand, $4,000,000 for 4,500 new machine tools for special Model A work, and $5,000,000 for dies and fixtures

in place for it now. All this has been done in a comparatively short time, less than six months.

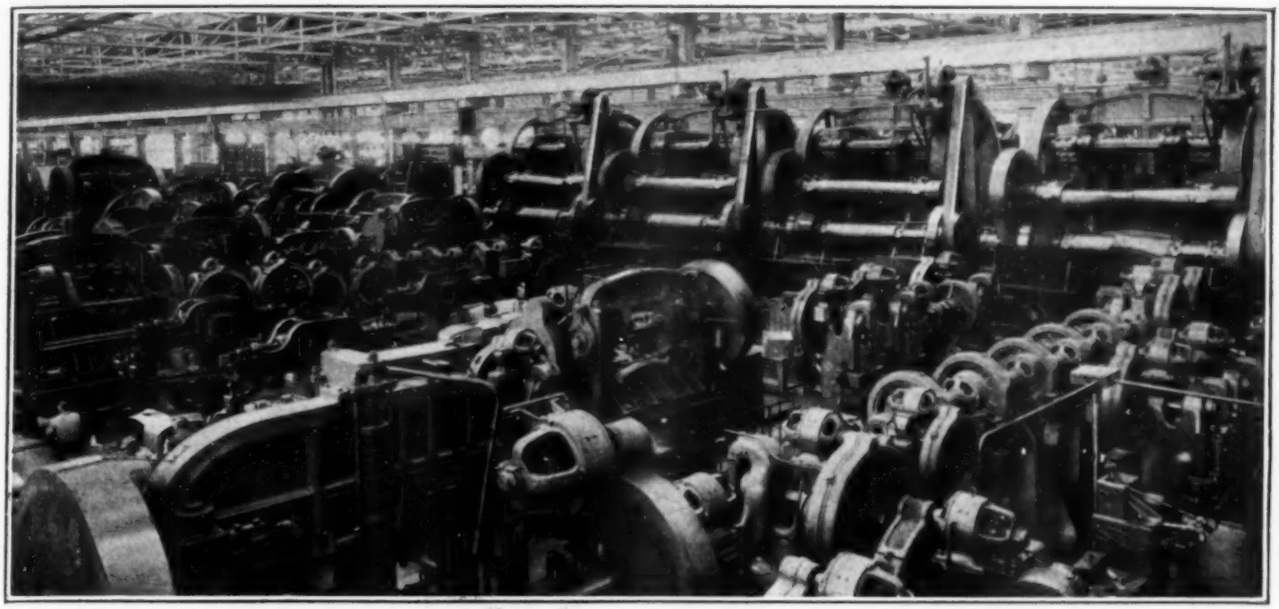
The Ford Motor Company has branches and manufacturing plants all over the world; the car must be serviced everywhere. Its parts must be interchangeable, must fit perfectly within the limit set, must conform to exact specifications of physical and chemical structure as well as exterior form.

To one who has visited the Fordson and Highland Park plants in Detroit and is familiar with only a few of the Ford Industries and the realization of what a change in the Ford model means in shop overhaul comes with striking force. To machinists familiar with details of tool design and jig manufacture, the job assumes gargantuan size. It cost over $15,000,000. In fact it is estimated that $25,000,000 will be a closer figure when the final costs are in. Fifty per cent of the machine tools had to be rebuilt. One hundred and sixty-six gear generating machines were completely rebuilt at a cost of $3,000 each, a change made necessary by the production of the two gears in the new Ford Model A rear axle. Then $4,000,000 was expended in the purchase of new machine tools and about $4,500,000 more went into the altering and remodeling of tools on hand. 4,500 new machine tools costing in the neighborhood of $4,000,000 were added for Model A special work, and $5,000,000 went into new dies and fixtures, which included a new set of body dies used in fabricating the new Model A steel bodies. Besides these large items, $120,000 was spent for the hot metal spinning machines for producing the rear axle housing, and $1,000,000 more went into the punch presses and other mechanical equipment of this nature.

The alterations and purchases of new equipment for making the new steel-spoked wheels cost $600,000. Three hundred welding machines, many of them built for Ford special operations, had to be provided. They cost from $700 to $9,000 each. Many of the flat-bed milling machines have been discarded or removed to other operations; these machines have been replaced by Ingersoll continuous-drum milling machines. There are three of these machines, for example, that machine cylinder blocks. Each machine takes 16 blocks at a time eight on each side. The rate of production is 250 cylinder blocks in eight hours.

The tool design department has been compelled to build hundreds of new and special Ford machines and an almost endless number of special heads, attachments, eight-spindle drill presses used for line boring push rod and valve guide bushing holes, jigs and fixtures; special tools by the score. Multiple heads, welders, new dies, many of them made necessary by processes evolved since

While production goes ahead at an almost unbelievable pace you do not have the feeling that the time allowed for single operations is too short for good workmanship



Ford shops look like an almost impenetrable jungle of machinery, but there are no overhead belts and there is an orderliness that suggests the well-kept park

mass production started, new conveyors, safety devices, literally hundreds of new devices for tributary machinery are still going through the toolrooms and maintenance shops at Fordson and Highland Park. The six toolrooms at Fordson are employing now about 8,000 men. The Ford shops, in Detroit alone, have nearly 100,000 on their payroll. It is expected that this number will exceed 125,000 when the production reaches 6,000 cars a day.

Reclaimed Steel Ship Being Used

The 199 ships which Mr. Ford purchased from the government for $1,697,470 have been cut up and the material stacked in the yards at Fordson. Some of the material is going into maintenance work, much of it, especially the steel is being reclaimed and used in the new car. Small parts are melted in the blast furnace, large usable sections are refabricated or rewelded and put into regular stores, other parts are cut into small blanks and used "as is." The miscellaneous piping and valves, the pumps and power plants and boilers are being reclaimed and used in various ways. Everything is saved, even the wooden parts. This is characteristic of this shop overhaul. Nothing is wasted, nothing thrown away. Somewhere in the forty-five Ford industries there is a place for everything. Some sub-standard men are being used in this salvage work and there is evidence of just as careful work here as elsewhere. It is amazing to see how well a tool or piece of waste material is restored to its former usefulness or diverted to another use, without loss of quality. Tool handles, broken, seemingly not worth repairing, are reduced in size and worked up again; oil cans, brooms, small tools, even waste rags, oil saturated, such as are seldom saved in other shops are reclaimed. It all takes time and costs money, yes, but in the Ford plants it saves profits which otherwise might go into the fire box or down the sewer.

When, on December 2nd of last year, the new Ford was shown, many predicted that such quality and close limits could not be maintained in quantity production. There were too many close limits, too many inspections, it was claimed. Such work cannot be put into big production and maintained, unless there are frequent checks on specifications and size, but these problems have been solved as have others of this car's design. Inspection methods are automatic in many cases; better ways of machining are responsible in others; finer tools, the wide use of Johansson gages, "go" and "no-go" gages, scales and other calibrating and balancing devices make the progress line move with the same deliberate ease as before. Of course it is taking time for the men to get into action and production has not yet reached the limits set, but it is coming along as well, in comparison with former Model T speeds, as similar operations proceeded in the old production.

The new Ford is a new car, new in every respect, from radiator to rear axle, a thoroughly redesigned job with a number of new and unusual features about it.

An Unusual Gasoline Tank

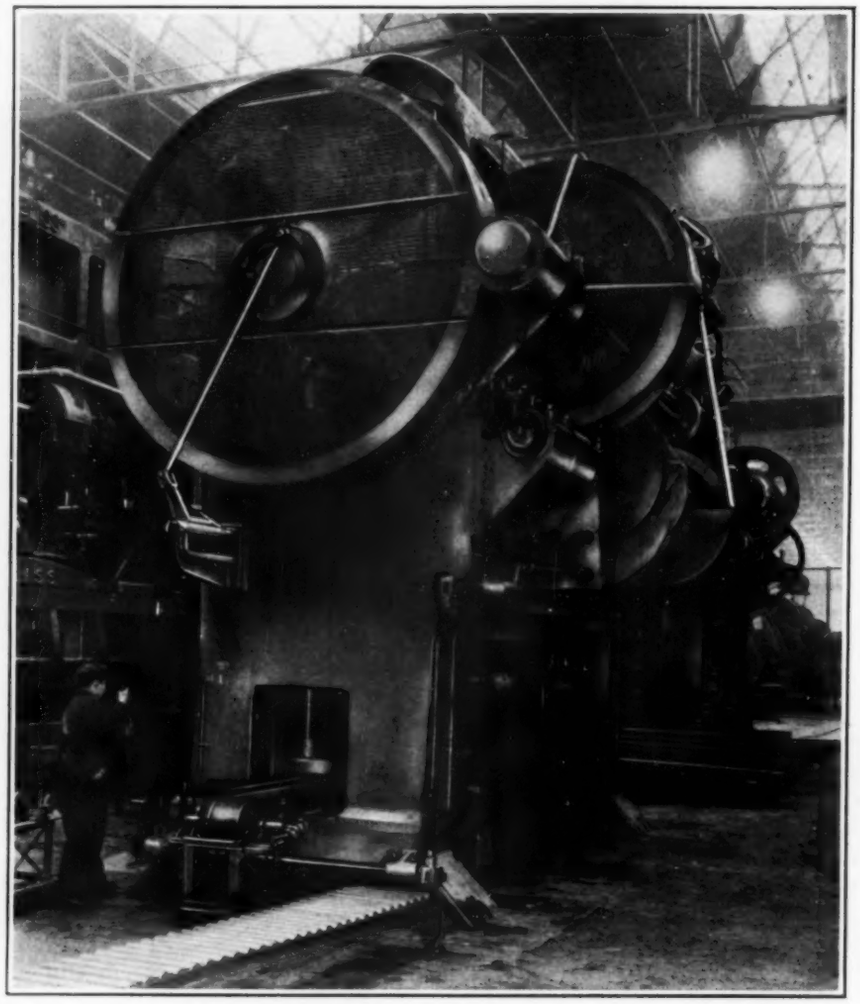
The gasoline tank, for example, which forms the cowl and the dash of the car in addition to performing its regular function as a reservoir for fuel, is made of No. 18 U. S. gage steel, or to be exact, terne plate, covered with a special tin and lead alloy specified at 12 pounds per thousand sq.ft. with not less than 16 per cent of tin. The production of this tank was an interesting problem. How was it to be done? Well, out in the pressed steel building you will find a group of large presses set in a carefully-measured process line, crowded it seems at first view, but with ample space it appears after study.

There also a number of welding machines and testing racks are located in the process line so that the work goes forward without interruption, no matter what the process may be. The tank is built of two main sections, pressed into shape and afterwards welded into final finished form. It is to be tested by air pressure. The exact process will be described in a later article.

Then there is the rear axle housing made of three parts, also welded together. The housing is spun out of sheet steel on a hot metal spinning machine, the axle tube proper is formed and seam-welded on a special electric welder. At the outer end the brake flange, after being forged to shape, is joined to the two other sections,

also by electric welding. It all looks simple now when you see the process but it's dollars to doughnuts that the designers burned a lot of midnight oil in figuring out how to do it.

Here and there throughout the Ford shops you will come upon pneumatic hammers and punch presses, scores of upsetting machines, dozens of electric furnaces through which conveyors cross and recross, special spring-fabricating machines that turn up an eye and bow the spring-leaf as easily and as quickly as you would bend a piece of cardboard, then heat-treat it and quench it. The new rear axle is now one piece; that is, the shaft and the gear are integral. While this is not a new process, nor new with the Ford Motor Company, it is interesting to note in passing as one of the many ways in which Ford has achieved durability. There is no chance for this gear to come off, there are no keys or splines. Of course a battery of gear-cutters is needed for this job. In the steel building there have just been installed pickling tanks, giant presses, conveyor systems, assembly tables, washing machine, dryer, and the spraying chambers for painting which make it possible for the frame to be completely fabricated, cleaned, painted and packed for transportation in one continuous train of operations. So carefully has this plan been worked out that the right and left members, which of course differ in form, travel in parallel lines at proper speed so that their supply will be equal to the demand in all parts of the process. Furthermore, the three cross members are so routed that they too join the procession at the proper points and proceed in the same orderly manner to the confluence of material flowing to the inspection table.



A giant press in which some of the millions of dollars worth of body dies are used

The two pickling tanks are of Ford design with water seals at each end. Their construction and operation will be described in detail in a later article of this series.

The Ford steel-spoked wheels are being manufactured in the Hamilton plant; the lamps at the Flat Rock plant; the steering gear, radiators, valves, roller and ball bearings, the ignition equipment, rubber parts, wire, leather, some drop forgings, some glass, Fordensite, storage batteries, some textiles, are being made at Highland Park. All the other production is going forward at Fordson where are also located the main process lines and the final assembly.

In many of the departments the process is not yet entirely standardized. Operation sheets are being constantly changed as new and better ways of doing the job are suggested or reveal themselves. The tool designers and production foremen are in daily conferences with each other. There are daily attempts made to eliminate operations, to cut the time required for specific work and thus get greater production. The elimination of many of the old style milling machines and the substitution of the drum type, the use of broaches instead of drills, new ways of peening bearings, forms of automatic inspection by parallel straight edges that automatically sort out under-sized and over-sized parts and pass only perfect ones, the wide use of scales for checking weights and balancing, the extruding method of producing piston pins, the very wide use of automatics, upsetting machines and presses make operations that were laboriously carried out in the old ways and on the out-of-date type of machines easy and accurate on the new. The close grouping of machine tools and the introduction into the actual process line of furnaces and inspection devices, the prevention of intermediate floor storage or reverse in stock handling, these facilitate the work, save time and labor, and incidentally profits. Many of the machines are so constructed that the introduction and removal of the work may be effected without stopping the machine tool, always an important item in reducing production time.

Electricity is being used widely everywhere in the Ford industries. There is a half million horse-power available at Fordson. Electric welders; spot, butt and seam-arc, are found in profusion throughout the plant. Almost all of the heat-treatment furnaces are electrically operated. All the machine tools are electric motor driven, and electric controlling and recording apparatus

make positive operation and economic control always possible.

The maintenance department, which is responsible for the tributary machinery, maintains several completely equipped electric repair shops, one in each building, whose men see to it that all production machinery is kept in operation and operating at the highest efficiency.

Five-ton and ten-ton cranes make the handling of even the largest pieces of machinery not a difficult task.

In general it may be said that throughout all the shops careful preliminary planning has made the replacing of machine tools a comparatively simple matter and the close fitting of conveyor lines to serve the various departments a routine job with which Ford engineers have had little difficulty in coping.

There are rows of Bullards, aisle after aisle of gear shapers, Ajax upsetting machines, clumps of Blisses and Hamiltons surrounded by thickets of Ferracutes. To the uninitiated, Ford shops look like an almost impenetrable jungle of machinery, but there are no overhead belts, the air is free above, the light streams in through the steel casements and despite the fact that the ground seems to be covered with conveyors and the air is filled with overhanging moving chains there is an orderliness that suggests the well-kept park. It is a clean shop, well ventilated, well lighted, and while production goes ahead at an almost unbelievable pace yet if you stop and watch single operations you do not have the feeling that the men are being driven nor that the time allowed for single operations is scanty or too short to allow for accurate workmanship. The workmanship is of good quality; it has to be to fit into the Ford scheme of things. It must fit the first time, there is no time for petty adjustment, it either goes or it does not. Ford interchangeability is *interchangeability*.

Rough Inspection Saves Time
Discussion

By J. T. Towlson
London, England

I HEARTILY approve of the suggestions made by Frank C. Hudson in his article under the title given above, on page 223, Vol. 68, of the *American Machinist*.

In my opinion, a good help to such work would be a heavy slab of cast iron, machined all over and provided with T-slots in both directions every 12 in. The upper edges of the slots should be well beveled so that no burrs will be raised above the planed surface. The slab could also have clearly-cut lines planed all over its working surface, forming squares of about 3 inches.

Accurately-machined angle plates having bolt slots and planed lines, and of sizes ranging from 12x12 in. to 6x6 ft., will be found of considerable service. With such a slab and one of such angle plates, a casting set on the slab true with any particular line may be roughly squinted for squareness and dimensions very quickly. By this means, the "general position" can be discovered before a square, rule or surface gage are brought into requisition.

The kind of square that I have found of greatest service is the stockless one, much like the millwrights' square, with legs in the proportion of 3 to 4 and graduated in eighths of inches.

Another useful device is what may be designated as a zero rule, in lengths of from 1 to 6 ft. In this rule, a zero line is in the center of its length and it is of great service in lining work that requires to be measured each way from a predetermined center line.

By such devices, with the addition of a graduated, swivel angle-plate and a protractor, the "liner off," though having a job that is by no means an easy one, will be able to keep his work ahead in a fairly large shop.

Protecting Machines During Shipment

SEVERAL methods are employed at the Fellows Gear Shaper Company to protect its machines during shipment to the customer, but in all cases the machine is covered by a one-piece paper bag, which is more or less waterproof and completely envelops the machine,

Machine covered by a one-piece paper bag inverted over it. The material is to some extent waterproof and excludes ordinary moisture

as shown in the illustration. The particular machine shown is to go in a carload shipment and hence the crate extends only to about one-half the total height of the unit. Where machines are shipped in less-than-carload lots, the crate envelops the entire machine to afford additional protection. For foreign shipment, of course, the machine is completely inclosed in a box.

Making Replacement Parts Pay Their Own Way

Supplying replacement parts for old machines discontinued in manufacture is one of the big problems that every machine builder faces. How this problem has been solved by a builder of many sizes and types of electric equipment will be told next week.

Keeping Machines Running

STINSON, of the Sun Motor Company, was having trouble because machine break-downs were throwing out his scheduled production. Having heard of William Holland's services to a neighboring company, and being able to make contact with him through an executive of that company, he had asked for an audience with the intent of securing suggestions as to getting out of this hole and keeping out of others. After telling his tale of woe in detail he asked what to do about it.

"Who looks after your machines?" asked Holland.

"Millwright gang or repair men, which ever you prefer to call them."

"And who calls them on the job?"

"The foreman. He is responsible for production and has to see that machines are OK."

"Looks as though something slipped then, doesn't it Mr. Stinson?"

"Yes, Mr. Holland, the foreman evidently waited too long before he called for help. That's what I want to prevent in the future. How do other shops manage it?"

"Too many do just as you've done—and with about the same result. Others work on various plans. One has a repair foreman who keeps an eagle eye on every machine in his charge. His men oil them all, tighten belts when necessary, adjust bearings and try in every way to prevent breakdowns. In some cases the repair foreman can order a machine stopped for repairs even though the production foreman might be willing to take a chance on its running awhile longer. Usually, however, they work together pretty well."

"Shouldn't think the production foremen would like that. Sort of treads on their toes."

"When there's a bonus for continued production and a deduction for time lost by breakdowns, men are not so fussy about toes being stepped on, Mr. Stinson. And some sort of bonus seems to help a lot in almost any shop."

"Are there any other plans, Mr. Holland?"

"A lot of them, I suspect. One that is very unique is working out well in a big shop in the middle west."

"More bonuses, I suppose. Have to bonus everyone to get anything done, I guess."

"Well, Mr. Stinson, when bonuses sometimes extend up to general manager we must not criticize the shop man for wanting his. But here's the plan, in brief:

"Each department has a given quota of men who can repair any machine in the department. They are part of the production force and get paid according to the output of the department as a whole. It's a 'gang bonus' plan and the total output of good work affects every man in the department, including the repair men.

"When everything is going right the repair men do anything they can to help the output, though their main job is to prevent trouble rather than to cure it. Bearings running hot, slipping belts, work coming out of the round are all signals for them to get busy before something serious happens. And they do get busy at the least sign of trouble.

"Should a breakdown occur, the repair men's pay stops until the department begins to produce again. And, as the whole department is losing out on its bonus when idle, men turn to and help the repair men get the machine running again, instead of sitting on the bench and watching them work."

"That's a new one to me, Mr. Holland. And does it work?"

"Been working for quite a while in a plant of several thousand men, Mr. Stinson. You might have to modify either plan to suit. And I'm not advising either though they both work. It's up to you to decide which you want to try—if either. But any plan that reduces shut-downs and machine repair costs is worth looking into."

Executives are invited to discuss the problem involved in the foregoing case. Accepted contributions will be paid for.

EXECUTIVE FORUM

Discussion

Handling Decreased Production

The answer to the question of handling decreased production would naturally vary with the class of work involved. For instance, a plant manufacturing agricultural implements or a similar line would be reasonably safe in building up a stock of standard machines because a good crop season would probably put an unexpected rush on the factory. In this line designs do not change, nor do machines become obsolete so rapidly as in the manufacture of machine tools.

On the other hand, factories engaged in the manufacture of machine tools would not be wise in building up large stocks, particularly on special machines. In fact, in the machine tool business today, improvements and advancements are so rapid that we do not believe it would be wise to build up stocks of even standard machines.

From the above deductions we would say that the question covers too large a field to be answered decisively and should be considered by each executive studying his own line and taking into view the possibilities of machines becoming obsolete or at least of being surpassed by a machine of later and better design. The answer to the survey should decide the question.

If you then decide to go ahead and build up stocks of machines, use the cash reserve if available, by all means, and save the interest, but if this is not available then borrow money to build.

—A. CADDIE.

About Wage Incentives

It seems to be the generally accepted theory that the men should be given a guaranty that their limits when established will never be cut. I do not agree that it is good policy to make any such guaranties.

Usually limits are cut because the foreman or engineer devises a quicker method. A new jig is designed; a new and more up-to-date machine is installed; the design is changed to cut down the amount of material to be removed; the quantity is increased so that a turret lathe instead of an engine lathe is used; carbon steel cutters are replaced by high-speed steel cutters; or the heat-treating method is changed so that a softer metal is obtained. All the resulting reductions in time can be credited to the management. They are not due to any ingenuity on the part of the operator.

It is only reasonable that the company should cut the rates and thereby take advantage of the savings thus effected. In some cases they may have paid out a large sum of money to effect these savings and the only way to get it back would be to cut the limits.

Another reason for cutting limits is because the estimator or time study man makes a mistake when setting a limit on a new job. Possibly the operator on whom the time study is taken is able to "put it over" on the time study man. He will in some way persuade the time study man that he can make only a certain speed. But when the limit is established, he materially increases his speed. A lot of workmen who are perfectly honest in other ways will resort to this trick. Why? Because while in the past he was honest when a time study was taken and gave his best effort, some other workman did less work while the time study was being taken, and since that time has been making more money because of the resulting high limit.

Also maybe an estimator who sets the limit by comparing it with a similar job or by figuring cutting time and handling time makes a mistake. When a mistake is made, I see no reason why the manufacturer should guarantee not to cut this limit.

Then, again, the workman may himself devise some new method after the limit has been established. For this, of course, he should be compensated. To cut a limit after the workman has effected a saving would be an injustice to the workman unless he is compensated in some other way. My opinion is that he should be given a flat sum of money to compensate him for his idea, not a dollar or two, but an adequate amount.

Rates should be raised when they are too low and cut when they are too high. If any guaranty is given that the limits will not be cut, the result will be that in time the limits on certain jobs will be away out of line and higher than the others. There will be a continual fight to bring the low limits up to the standard of the high limits. I think that limits should be set only for a specified time. After the same time limit has been in use for, say, two years, the chances are that it is no longer correct.

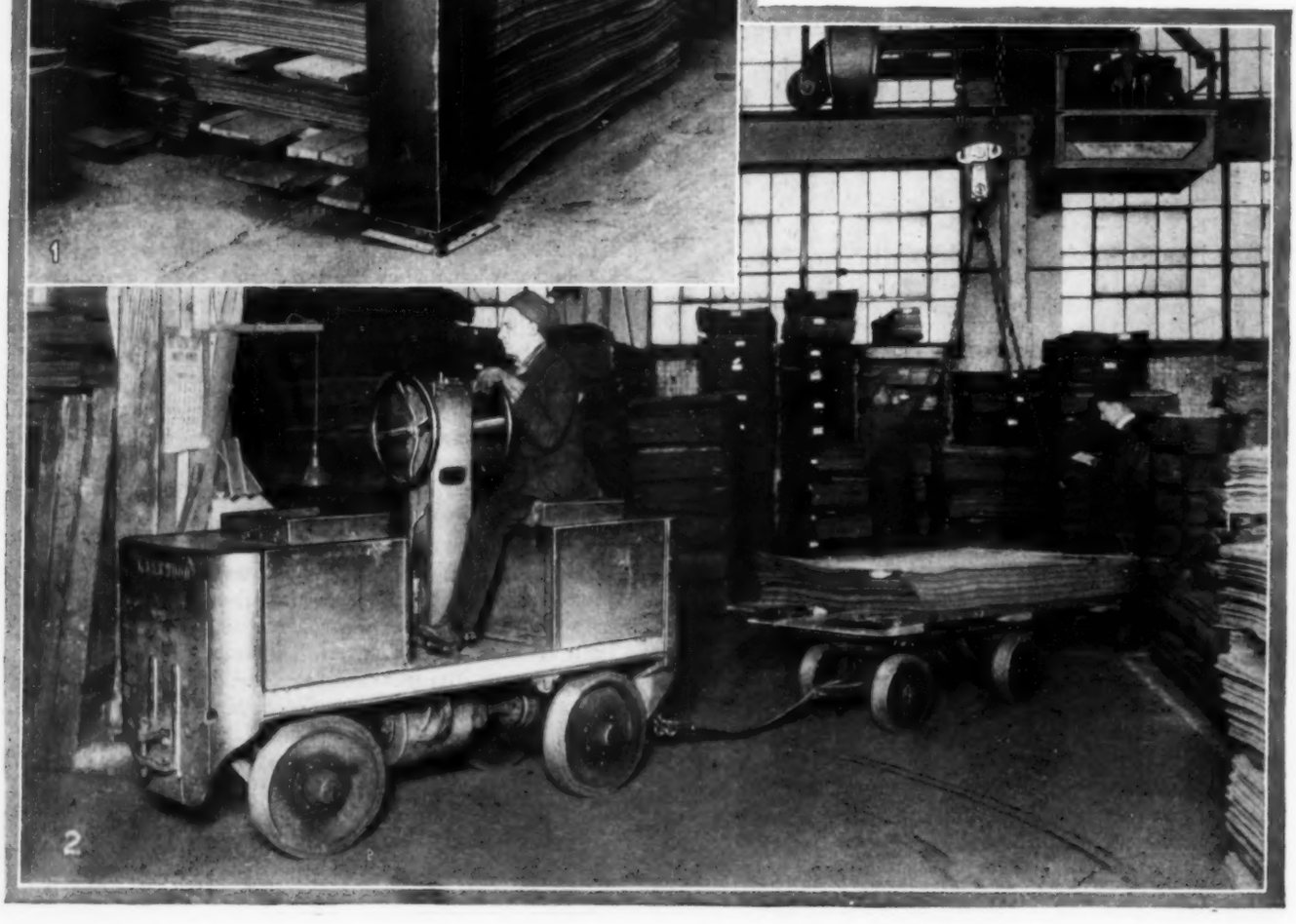
As I see it, if the management continually impresses on the machine operators and on the time study men and estimators the idea of fair play; if the idea that what is wanted is fair play, both from the workmen and the rate setters, can be put across, the minimum amount of trouble will be experienced.

—WILLIAM C. BOSTON.

Next Week

Making Power or Buying It

Storing and Handling Sheets in a Press Shop



Figs. 1 and 2—Where 12,000,000 lb. of sheet metal is kept regularly in stock for filling the requisitions of the punch-press department, with an average complete turnover every eight weeks, the storeroom must be highly efficient in exercising control over accessibility of all sizes, dispatch in handling, and ready inventory. The sheet-metal storage serving the metal-stamping department of the Westinghouse Electric and Manufacturing Company is a building 250 ft. in length with two 10-ton electric cranes running the full length of the room. Two railroad tracks enter at one end, permitting space for four cars to be unloaded at once, the tracks being submerged so that the car floor is level with the storeroom floor

The steel sheets are made up in lots of from 3,500 to 5,000 lb. each, and piled on skids as shown in Fig. 1. The stacks are usually from 5 to 10 lots high, and are laid out in rows to permit transit of the trucks. The end stack is shown with a truck buffer to protect the corners. In Fig. 2 is shown the method of loading the lots by chain tackle, and trucking to the shearing room

Photographs by courtesy of the Westinghouse Electric and Manufacturing Company

In Fig. 3 is illustrated the stock of steel sheet with inventory card holders. The card gives the size, gage, and quantity of the sheets in the stack. The method of piling boxed sheets for storage is shown in Fig. 4. In order to keep down the number of sheet sizes in stock, a selected list of widths from 20 to 39 in. are stored, with lengths usually three times the width. Sheets are sheared to the required size, as shown in Fig. 5, before delivery to the press room. Experience has shown that it does not pay to save and store the waste ends sheared off of the sheet, except certain designated sizes. When a requisition for press work is sent into the press shop a copy is also sent to the materials storeroom so that the sheet metal will be ready for the pressman at the designated date

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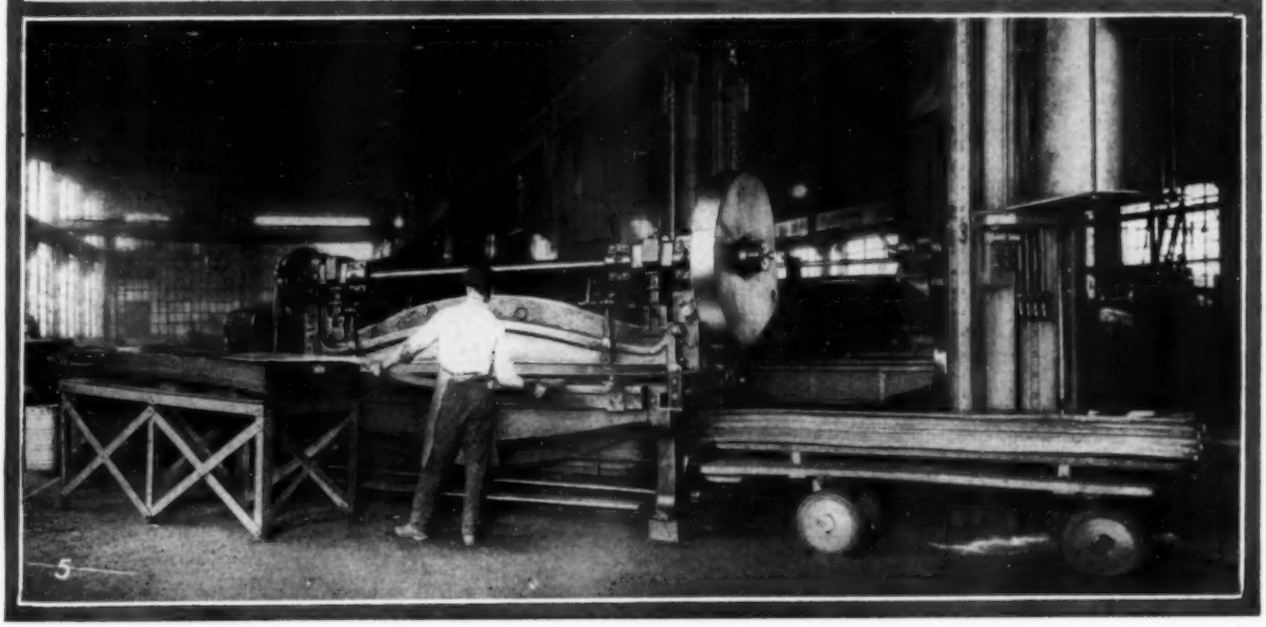

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Trucks and Tractors in the Shop

Photographs by courtesy of the Jeffrey Manufacturing Company
Columbus, Ohio

Fig. 1—Lift truck and the type of boxes and frames used on the platforms. The frames are made of corrugated steel and have corner pieces that lock into either wood or steel frames, or boxes. They are interchangeable

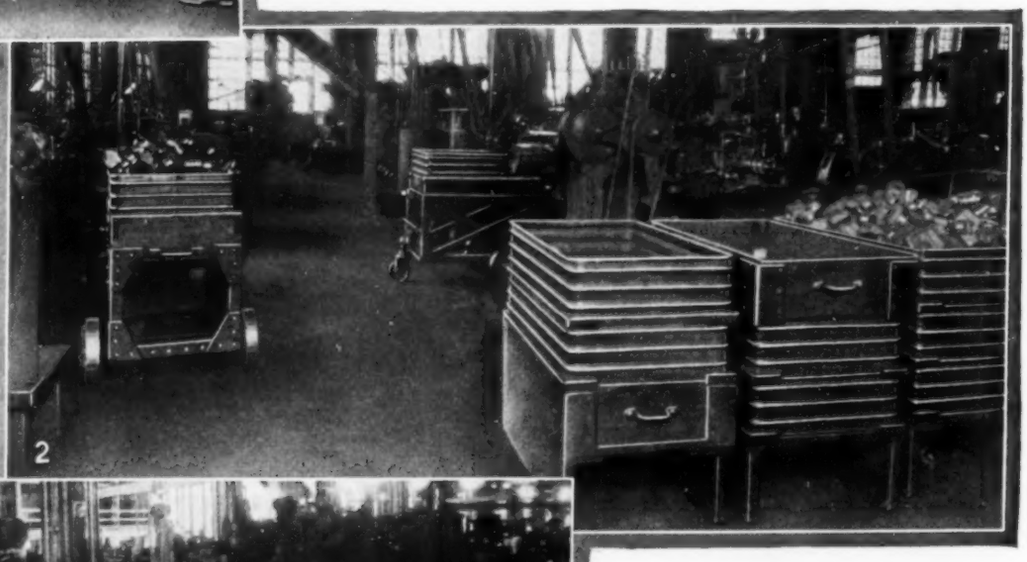

Fig. 2—Steel-framed three-wheeled trucks for carrying boxes of wood or steel from machine to machine. The boxes keep the work off of the floor and at a convenient height for the operators.

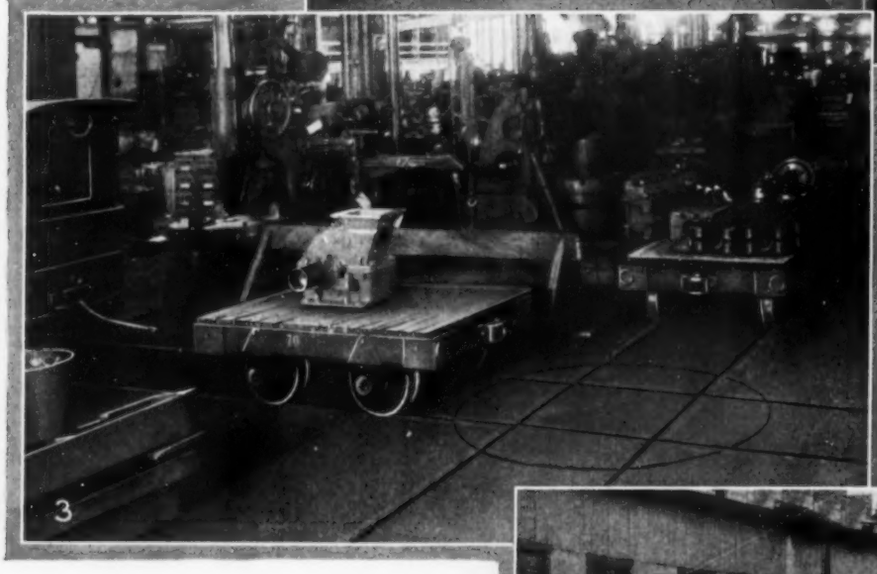

Fig. 3—Two small flat cars on the industrial railway in a shop. The turntable at the junction of the two tracks makes it easy to transfer the cars or an electric tractor from one track to the other. The railway serves all the heavy machines

Fig. 4—Storage-battery tractor towing nine cars from the shop to the shipping department. This locomotive also handles individual cars in the shops in carrying material to machines

Lifting Devices at the D&H Shop

By Frank C. Hudson

Fig. 1—Special tongs for lifting connecting rods

Fig. 2—The same tongs having two chains, one at each end

THE time saved and the safety secured by using adequate and convenient lifting and handling devices, well repays giving the matter very careful attention. Probably more accidents occur from the slipping of chains, ropes or clamps than from any breakage of lifting devices, so that slippage is one of the main points to be considered.

The length of connecting rods makes them somewhat awkward to handle. Chain, or rope slings are liable to slip unless attached to the ends of the rod, which is not convenient except on short rods. To obviate these difficulties, the hoisting clamp shown in Figs. 1 and 2 has been made to handle rods of any length. And though it is desirable to suspend the rods from as near the center as possible, it is not as necessary as where slings are used.

Two methods of applying the tongs are shown. In Fig. 1 the chain is in the center and in Fig. 2 a chain is used at each end. The first method is used on short, light rods and the second on long, heavy rods. In either case there is no danger of the rods slipping either endwise or sidewise, the latter slippage being prevented by the turned-down ends of the crossbars. These ends are long enough to span a pair of rods so that two can be lifted at once. To hold the tongs in position and to prevent them from closing together, pivoted stops are attached to each jaw. In the position shown they hold the arms apart, but they can be raised and allow the arms to come together should it be desirable. The tongs are of boiler plate and are cut out by a gas torch. Small bolts are provided for attaching the chains to prevent them from being mislaid. A pair of tongs for handling driving boxes on the slotter and boring mill, is shown in Fig. 3. The tongs are easily adjusted on the driving box and hold it securely.

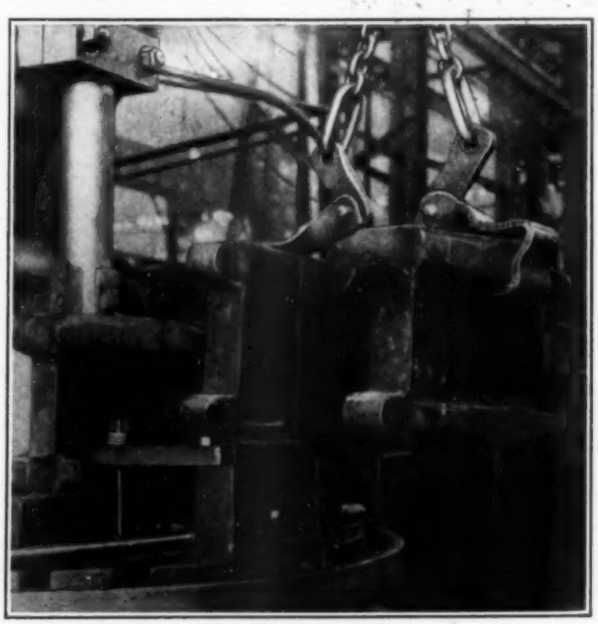

Fig. 3—Driving-box hoisting clamps. Cut from steel plate and bent so that the center jaws go under the side of the box; outer arms clamp the box on both sides

A somewhat similar pair, though more on the ice-tong order, is used for handling truck wheels, as in Fig. 4. While safety is the first consideration, the ease of attaching and detaching has been taken care of.

For lifting and carrying driven springs, a double loop arrangement is used, as in Fig. 5. This device forms a sort of cradle in which the springs lie, several being handled at once when necessary. The tongs are hinged at *A*, the bands *B* acting as stops to keep the lifting straps beneath the springs, the desired distance apart. Rods, as at *C*, are safety devices to prevent a man from getting his fingers pinched if they should happen to be on the bands when the load reaches the floor and the tongs open. These rods are loosely hinged but always prevent the upper and lower crossbars from coming together when the tongs are being opened after touching the floor. The piston-rod clamp, Fig. 6, is quite similar to the one for lifting truck wheels. The difference is in the shape of the lifting jaws, and the fact that the jaws are copper lined to prevent marring the piston rod after it has been finish turned or ground. Boiler fronts are awkward to handle, especially in putting them in place on the locomotive. The hook shown in Fig. 7 is so shaped as to fit in the center opening and to hold the front approximately vertical while being lifted by the crane. In this position it is easy to put the front in place. The front shown is being shifted from one locomotive to another. As the spacing of the studs is seldom alike on the front-end rings of any two locomotives, the front is salvaged instead of being scrapped, by filling the old bolt holes by

Fig. 4—Simple tongs for lifting and handling locomotive truck- and car-wheels. They cannot slip when under load and do not project sidewise so as to interfere with wheel press or lathe

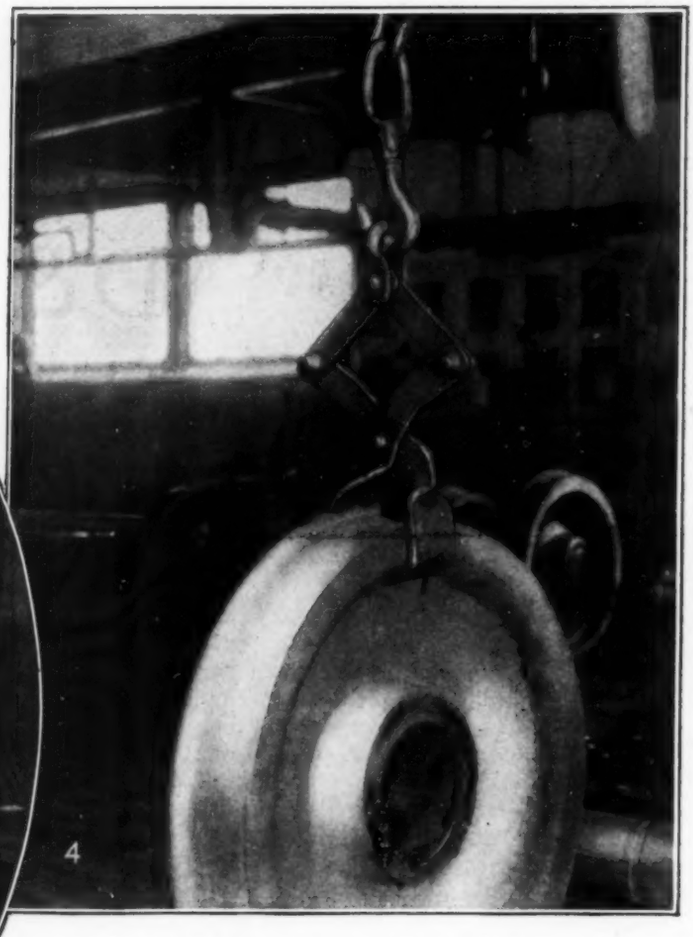

Fig. 5—Double tongs, or cradle, for handling driver springs. This device holds several springs at once and handles them safely. The two round rods with projecting ends prevent the bars from closing enough to pinch a man's fingers as the tongs open

Fig. 6 — Plain, toggle clamp for lifting piston rods, either with or without the piston being in place. Similar to truck-wheel clamp, except that the jaws are lined with copper to prevent marring the rod

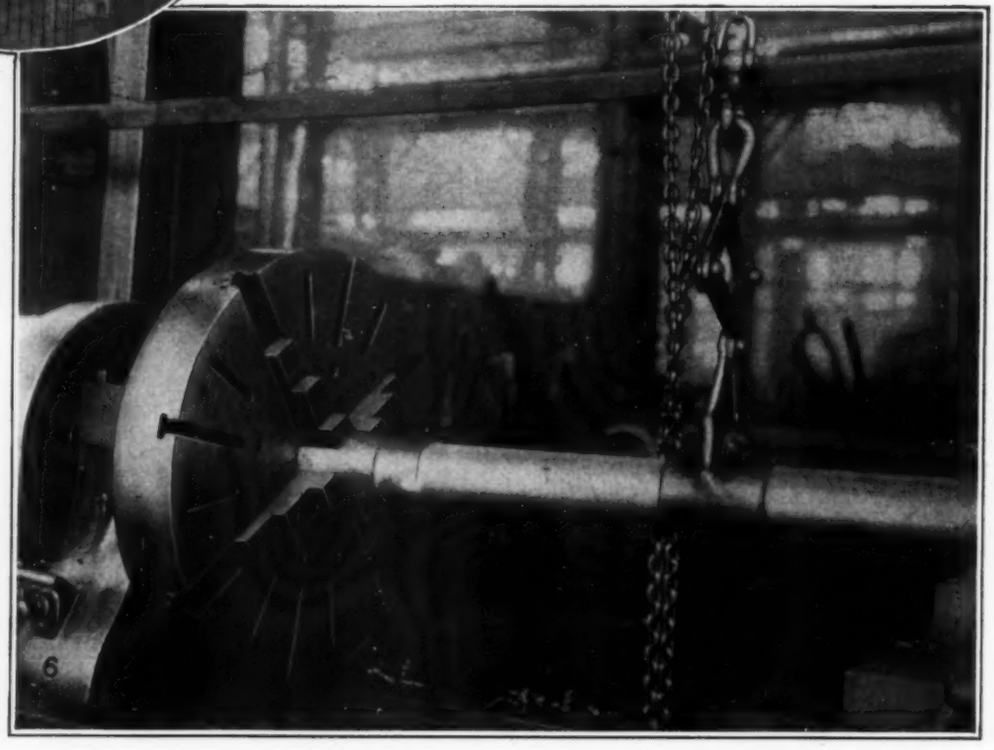

Fig. 7—Hook for lifting boiler fronts and holding them in place while being attached in place on the locomotive

means of welding by the acetylene process and drilling a new set of holes to suit the studs that are already in place in the front-end ring of the locomotive to which it is to be transferred.

In following this practice a very decided saving has been made over that of scrapping the old fronts and making new ones, which, beside the cost of the castings and the delay in getting them from the foundry, involves considerable expense in machine work.

Normalizing Locomotive and Car Parts

By J. S. Browne

THE shops of the Western Alabama Railroad at Montgomery handle all repair work for the Western Alabama Railroad and the Atlanta and West Point Railroad, which includes 53 locomotives, 53 passenger cars and 1,700 freight cars. When an engine or car comes into the shops for general overhauling, all side frames, equalizers, rods and other moving parts are taken off and given a normalizing treatment to relieve any crystallization or internal strains set up in the metal during operation. These parts are of forged steel, cast steel or hammered iron, and are all given a similar treatment.

The parts are placed in an oil-fired car-bottom furnace measuring 4 ft. by 15 ft. internal dimensions, and soaked at a temperature of 1,650 deg. F. The time in the furnace is estimated by allowing one hour for each inch of thickness of the part. They are then removed and allowed to cool in still air. The parts are not distorted by the treatment, and only require cleaning before being replaced on the rolling stock. It is claimed that the periodic normalizing prevents breakage of the parts in service.

SEEN · AND · HEARD

By John R. Godfrey

Using Fewer Castings—Jig-boring Machines

ALMOST every advance in civilization has meant changes that have thrown somebody out of a job. They naturally objected, sometimes strenuously and violently, but the changes went on just the same. The ones who were not affected looked wise and talked of the short sightedness of those who oppose changes, which is what most of us do when it affects our jobs. It's a lot easier to be philosophical when the other fellow's bread and butter is at stake. Some day we may realize that these changes are bound to come and are a part of the hazards of industry.

Just at present the foundrymen are feeling the trend toward structural steel and sheet metal. Instead of making a pattern for but one jig or fixture, or even for a large generator, some shops are now building it up of steel plates, cut and welded with flame torches and arc welders. Steel foundries are trying to induce those who now use cast iron to switch to their metal. Many light castings are being replaced by sheet metal stampings that are wonderful examples of how cold metal can be coaxed into intricate shapes if one knows how. Castings still have a place and there will probably always be uses that cannot be met as satisfactorily in any other way. But there is as much opportunity in the finding of new markets as there is in getting back much of those that are now being supplied by other processes. It's up to the foundrymen to search them out if they want to retain their rightful position in industry.

* * * *

One good example of the changes that have taken place is in the method of locating holes in jig plates or fixtures. From the old fashioned layout methods where we used scales, prick punches and dividers, aided by the "draw" chisel to coax the drill to stay within the scribed lines, we graduated to the "button" method and considered it the acme of toolroom perfection. Nor is there any question as to the accurate work that has been turned out by that method. But the button method is fast giving way to the use of jig-boring machines of one kind or another.

Beginning with very accurate milling machines used in locating holes in bushing plates and similar work, we have developed special jig-boring machines that are very accurate and that save a lot of time. As an example of their usefulness, a friend tells me of drilling a small jig plate with twenty holes, located with a total error of less than a thousandth of an inch, in 55 min. The jig was for a small job—the drilling of a few sheets of fiber—which had to be accurate. There was no time or no need for a plate with hardened bushings. The plate of cold-rolled steel answered every purpose, was very accurate, and was made in less time than it would take to lay out the twenty holes in any other way. It looks as if the makers of layout-buttons were going to be out of a job.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Promoting Interest Among the Boys

"WHY the sudden big brother act, Al? I've noticed you're spending a lot of time with the apprentice boys in your department lately."

"Yes, I am, Ed, but I hadn't thought of it in the way you mention. Been considering it entirely as part of the job of being foreman. Trying to work out a new idea, but I'm not getting very far with it yet."

"What's the big idea, Al?"

"Been reading and thinking a lot about the whole machine industry, Ed. We know it's back of everything else—that it's the most necessary industry after the bare necessities of eats and shelter. But it isn't an easy job to make it seem interesting to the boys, or to the men, either."

"Well, why worry about it, Al? What's that got to do with getting the work out?"

"A number of big shop managers think it has a lot to do with getting out work, Ed. They blame lack of interest for many of our troubles."

"As what, Al?"

"Labor turnover, carelessness and spoiling of work, lack of skilled mechanics for special jobs, and lack of good material for foremen."

"But if a man doesn't make good we fire him and get some one who will."

"Perhaps, Ed. We fire him, but we don't always get a man who makes good. What we want is to get them really interested in the job so they'll want to make good—just as they do playing baseball or pitching horseshoes."

"Well, what's your scheme, Al? How are you going to do it?"

"I don't know yet, Ed. I'm sort of feeling my way along. If we built airplanes, or airplane engines, or instruments it would be easy to show the men how big a part they are playing in making Lindbergh's flights and all the other work possible. But it isn't so easy to dig up much romance about brick machinery, or concrete mixers or the like. But they're all necessary, or we couldn't have our buildings and our roads."

"I'll say it isn't easy, Al. Don't see how you're going to make a dent in it. What line are you working on now?"

"I'm just sounding the boys out to see what might interest them. Some want to know who fathered the machines we use, others seem interested in knowing about where the materials we use come from, and still others want to know where the machines we build go, how they are used, what happens when they break down, and so on."

"And what are you going to do about it, Al?"

"Tell them what I can about all the things they want to know. I'm getting some lantern slides made of some of the things they asked about, and I'll show them some night."

"But you can't show the whole shop."

"I know it. But after I learn a little more about the boys I may get an idea that we can work out on a larger scale."

"I'll say you've tackled a real job this time, Al."

Is Al wise in thinking it may be best to begin with the boys? Or do the movies and dances make it harder to get them than the older men? How can he hold their interest?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

He Never Asks for a Raise

BILL HAWKINS used a very logical means of expression, and one that was perfectly natural to him and his position, when he figured to let his work talk for him. Anyone who has not studied the mechanic in such a situation can hardly appreciate the mental agony that he goes through in leading up to such a question. Is the foreman in good humor? Did I please him on the last job? Is he too busy now? These are the questions he asks himself, with resultant effect upon his present job and nerves in general. If you have studied him, you can appreciate the man who refuses to tread unfamiliar ways, and prefers to let his work speak for him.

It is good policy for the management to give a raise voluntarily when it is deserved. It is reasonable to suppose that in the case of the man on daily wage, his increased value will not be recognized until it is very apparent. So, when he stands out, I'd favor giving him the raise, whether he asks for it or not.

—A. D. KLIGMAN.

A MAN who will continually quit a job if a voluntary raise is not forthcoming is, I believe, a little lacking in the proper attitude. If he does not consult anyone but himself regarding his ability as a mechanic, he will come to the only conclusion possible, i.e., that the firm does not appreciate his ability enough to give him a raise within a certain time. If he persists in this attitude, he will find that sooner or later the foreman will pass him up in favor of the workmen who are at least willing to discuss their affairs. If Bill had approached his foreman on the possibilities of a raise he would have found him only too glad to enlighten him as to his future possibilities of the job.

—F. E. BIRD, *Canada.*

Paying a Bonus to Outsiders

I CANNOT see why a company should pay a workman a bonus for a suggestion whereby the time on a job is lowered. That is what every workman should be looking out for, and by that method raise his hourly rate. If I were the man on the job, I would feel that I was doing what was expected of an operator, and that my own personal services to the company were becoming more valuable. Any fair-minded foreman would feel the same way, and would see that I got what was coming to me. If a bonus had to be paid it would be very difficult to figure out the percentage of savings. It is not always known just how long the operation may be continued, as there may be changes in design which would render the operation obsolete.

If I were an operator I would thank a man for making a suggestion which would enable me to do considerably more work without expending any more energy, and try and think for myself the next time.

—R. Q. TARBUTTON.

ANY man making a suggestion which results in a saving of time or material, and consequently a reduction in the cost of producing an article, should receive a bonus, no matter if the suggestion concerns his own work or the other fellow's. The bonus should preferably be based on a percentage of the estimated total savings. It would be a good idea if the award were given by a committee having shop representation.

—J. T. TAYLOR.

Shall It Be Layoffs or Short Time?

WHERE highly specialized men are employed by a factory, it is very inconvenient to lay them off for several weeks, for in all probability it will be impossible to get them back. New men would have to be broken in at the cost of loss in time and spoiled material which would be higher than the cost of running on short time.

Williams should decide a course of action and assume full responsibility for it. To permit the workers to decide such a matter would cause disturbances in their ranks which would tend to lower the shop morale.

—FAUSTO RECERRIL, *Military Engineer, Mexico.*

THE necessity for reduction in force happens about twice each year in our shop, as most of our work is seasonal. I first lay off the men who have been on the job only for a short time, and who do not have a general knowledge of our work. Then, if I do not have enough work to keep the shop on full time, I put it on short time, holding my trained force together as long as possible. Some of our men have been with us for as long as 25 years, and I have made it a practice to

THE · NEXT · TOPIC

Something Besides the Pay Envelope

ADVANCE QUESTION

Ed doesn't see anything but more wages to interest the men in the job. Al believes there are many ways of arousing and maintaining interest, after the pay is all the job will stand. What is your opinion?

train them in all branches of the work, so that when it comes to short work, I can move the men around on different jobs.

When a contract comes in, demanding an addition to our force, I first get in touch with the men who have been laid off, and call them back, but it often happens that these men have found other jobs and are gone.

—M. V. DUMIRE.

ANYONE who has had direct personal contact with the men in the shop knows that there is a great feeling of mass sympathy among them. I feel certain that the old-timers would be willing to sacrifice by going on short time, just to keep the crowd together. They have probably been through similar periods before, and some time in their earlier history they have been the ones laid off, and have not forgotten how it feels. So Al had the right slant on the situation. I would do the same thing in my own department, for this putting it up to the men builds company morale out of what would otherwise be a very demoralizing situation. Under such circumstances, if the men choose part time, you can rest assured that they will see to it themselves that every man does his fair share of work. —B. E. LAMBERT.

THERE are two sides to this question, one humanitarian, the other one that shows in the profit and loss account. From the humanitarian side the thing to do depends on whether or not the men who are laid off can get other work. Considerate treatment, it is hoped, would cause the men to come back when the business picks up.

If foremen and straw bosses are paid by the year, a good opportunity is provided to let some of them renew their acquaintance with actual shop work by putting them back on the machines for part of the time during the slack period. The cost department should be able to figure out which way will produce the least loss. It hinges largely on the overhead. —ENTROPY.

Is the Kicker Always a Nuisance?

NO MAN likes to be reminded of things that have not been done, when he knows that they should have been. Ed ought to have realized that Bert's complaints should not be regarded as a nuisance, but as a sign of his interest in his work and surroundings. The nature of the complaint shows that Bert does not complain without cause, as is so well realized by Al. It seems to me that one of the qualities of a good foreman is that of noticing things other people have overlooked. Bert's desire to see the improper condition set right comes from a proper spirit which will get him somewhere.

—T. L. RICHARD, *England*.

Too Many Safety Signs

I BELIEVE with Ed that signs are useful and that the way to avoid their becoming a nuisance or overreaching the mark is to use originality. It would be advisable to have someone make a study of the possible causes of accident or injury in a particular works and produce some pictures showing how such accidents occur and the means of avoiding them. Pictures are quickly comprehended, and the cumulative effect of a constant succession of them for two or three months would have its effect upon the shop force. However, this policy should not be pushed too far by posting signs on every available space. It might be advisable to permit the men in the shop to make contributions of subjects for these pictures. —H. J. KENNEDY.

Training the Foremen in Management

INSTEAD of simply having speakers talk on factory management, concrete management examples or problems pertaining to management activities should be discussed in these classes by officials and foremen as well. Unless these problems are discussed and solved during these gatherings, it is simply a waste of time to hold classes. You cannot train foremen by talking management to them, but it can be done by an exchange of opinions. —PAUL LINDER.

WE DO NOT expect that the superintendent can step in at a moment's notice and run every machine with the same facility and speed that the regular operator does, any more than we expect that any foreman can take over the superintendent's or any other management job. Foreman training should not hope to accomplish this, but what it should and can do, is to give the foreman the same general knowledge about management problems that the management has about the details of any mechanic's work. —M. J. KAPLAN.

FOREMEN must be trained for foremanship just as the mechanic must be trained for a trade, but it requires a different type of training altogether. The average foreman's preparatory experience while a workman in a shop will not usually develop good judgment and tact in human relations, nor is it likely to cultivate leadership qualities. The average foreman may be a good technician in his own departmental work, but on other counts is rather narrow and short-sighted, which prevents him from seeing opportunities for improvement along other lines.

If the value of the course is explained to the foreman, he will usually be interested and will desire to take it. From the company's standpoint, however, it should be a necessary part of the foreman's job. If the foreman does not want to take the course, it should not be forced on him. After all, he will be the loser, since his refusal will reflect unfavorably on his spirit of co-operation and ambition. —H. KAUFMAN.

Extra Pay for Extra Effort

A BONUS should not be paid to an operator because he has devised a method for increasing production. He could not reasonably object to this since the short cut enables him to get the increased output with his former physical effort. This is his reward for being one step ahead of the job. However, no attempt should be made to limit the operator's earnings by changing the piece-rate as production speeds up. It is often done, and is always a boomerang. The wiser plan is to encourage the operator to put forth his most economical effort, bearing in mind that any gain to the operator produces a corresponding return to the employer.

—A. B. GOULD, *Mechanical Engineer*.

Inspection in Modern Industry

By Sydney French
Chief Inspector, Pratt & Whitney Company

An outline of the factors and methods that must be considered in developing and maintaining an inspection department in a modern plant

THE necessity for a thorough system of inspection and the advantages gained thereby are now recognized by all modern manufacturing organizations. Whereas inspection was formerly relegated to an inferior position in shop procedure, it now occupies a place in the front rank.

Let us first think of the inspection department as a machine or an instrument for producing the control of quality, together with certain secondary duties to be combined therewith as a matter of economy. Also, we may consider the organization of the inspection department as comparable to the design of a machine, and the administration or management of such a department as comparable to the operation of the machine thus designed. The general purpose of inspection is not only to give customers the fullest possible guaranty of reliability in the product purchased, but also to act as a stimulus for the maintenance of the highest standards in design and materials. Careful inspection also affords the manufacturer a means whereby his product will easily be recognized in his field, in contrast to inferior and unapproved goods. The chief end to be sought in the management of the inspection department is to obtain a firm control of quality by holding the work to predetermined standards. This must be accomplished with the maximum economy, while rejecting all that fails to come up to the adopted standard. A gross misconception exists in the minds of many that good inspection is governed by the amount of material rejected. Such is not the case. Rather it is the display of judgment on what constitutes a desirable standard to maintain the quality of the finished product, thereby maintaining prestige in the selling field.

The proper inspection of the varied parts of an interchangeable product is one of the most important as well as difficult tasks in manufacturing. If, on the one hand, inspection is carried on in an arbitrary and exacting manner, production is retarded and costs are increased. On the other hand, if inspection is performed in a perfunctory and lenient manner, it is worse than useless. This kind of inspection will not prevent the sending out of an unsatisfactory product that in the majority of cases has been expensive to build, and much of this expense is due to interferences at assembly which have had to be corrected before the finished product would function.

With some organizations, the tendency with many of the production departments is to neglect all thought of the ultimate use of the parts in process and to concentrate on efforts to increase quantity. The standard in some cases seems to be anything the inspector will not reject. This attitude gives rise to an inevitable situation of the production departments seeking the line of least resistance. On the other hand, some inspectors arbitrarily insist on the exact letter of the drawings and specifications without regard to the ultimate use of the part in question. Neither of the above methods is at all satisfactory. Inspection must be intelligent because, even in the best regulated organizations we seldom find a condition where drawings and specifications are complete enough to be followed blindly. The mere meeting of the drawing specifications is not in itself the prime object of manufacturing. The main purpose should be to promote economical production of a superior finished product. If the inspection is to accomplish its part in the work, discretion should be used and due consideration be given to many factors.

> Inspection must be recognized as an important factor in modern production. The inspection department must be organized so as to aid production and to increase the plant's reputation for accuracy. The inspector must not feel that his duty is to reject as much work as possible, but rather to determine how large a percentage of parts can be used satisfactorily in the finished machine. The higher up the inspector, the greater judgment he must exercise

When a component part is not in accordance with the drawing, any one of several conditions may obtain. First; the part may be wrong and the drawing correct. Second; the part may be correct and the drawing in error. Third; both the part and the drawing may be correct; and finally; both the part and the drawing may be wrong.

In the first case, if the part cannot be salvaged it

must of course be scrapped. In the second case, the part should be accepted and immediate steps taken to have the drawing corrected. The third case requires less consideration and the work should be accepted. In the fourth case, the drawing should immediately be corrected and replacements made in case the rejected parts are incapable of being salvaged. It is obvious that when a great volume of production is involved, discretion can be exercised by but few of the inspection personnel. Hence any abnormal volume of rejections by the inspectors should be the occasion for a re-inspection of the rejected parts by persons competent to locate the error, whether in the parts or the drawing.

From the foregoing it is clear that the inspection department among its other duties, must operate as the eyes of the engineering department. For this reason the inspection department in many plants reports to, and is virtually a part of, the engineering department. In other cases it is a distinct department and is responsible to the manager. Either plan works out well. In no case should it be a part or subordinate to any section of the production departments. The duties of the production and inspection departments are so incompatible that they never should be combined, as one or the other is bound to suffer. Nevertheless, the inspection should be carried on in close co-operation with the production department, and with every other department of the organization.

The executive head of the inspection department should be thoroughly familiar with general engineering practice and standards. He should be well informed on all modern shop methods and practice, and be thoroughly versed in the use of testing machines and gages. Moreover, he should be familiar with the uses of the product and the conditions under which it is to operate after it has passed beyond the control of the factory.

He must have control of every inspector in the plant and be held responsible for the quality of material and workmanship of all that the plant produces. His position is one of trust, hence character is indispensable. Good judgment is requisite, not only the judgment that flows from "mechanical sense" and skilled ability as an engineer, but judgment born of plain "horse sense." In addition he must be an executive of no mean ability. In selecting a man to take charge of the inspection department, there arises the problem of outlining what the department is to include. Conversely the amount of work that it is expedient to include will largely determine how big a man should be selected to head the work. The two things always go together and the resulting solution is usually a compromise.

Duties of Inspection

The duties of inspection comprise a number of things that are not strictly inspection, because it is economical and wise to include them in order to secure a more complete control of quality. These duties may be outlined as follows: (1) Raw-material inspection in co-operation with the laboratories as to chemical and physical properties. (2) Heat-treatment of steels as to hardness and freedom from defects that may often reduce the liability of allowing hardened parts to proceed down the sequence before the defect is discovered, thereby adding useless expense. (3) Tool inspection, more especially if the factory maintains a toolroom. (4) Gage checking and the verification of manufacturing and measuring standards, all in close co-operation with the chief engineer. (5) The general inspection of the various assembly units before final assembly with mating units that comprise the finished machine. (6) The checking of alignments and general details as to quality of finish, particularly as applied to machine tools and special machinery. (7) General supervision of the factory salvage department where the accumulation of rejected parts are again reviewed before final disposition.

In assigning the duties of the inspection department organization, it is necessary to place the personnel so as to grade the amount of discretion to be allowed in matters requiring the exercise of judgment. One might say that the amount or quantity of judgment to be applied by any individual member of the inspection force should be decreased as we go down the line from foreman inspector to the inspector working at the bench. The inspector applying gages at the bench should not only have good eyesight and possess tact. He must also be temperamentally suited for the work. His duties largely consist in inspecting work that is clearly up to standard, work that is not up to standard, and work about which he is doubtful, leaving the decision as to the latter class of work to his immediate superior.

The floor inspector should be of an entirely different class. He has the important duty of "first piece" inspection before he authorizes a machine to begin a run of work. In addition, he may be given the right to order a machine stopped if the work is not to his satisfaction. This calls for good judgment backed by practical experience.

An Incentive for Inspectors

In the management of the various units of inspection, every incentive should be used to encourage the idea that the department is an excellent place in which to work, and more important still, a force that a man should be proud to belong to. The work can be made pleasant if the inspector is treated by his executives with just a little more friendliness or courtesy than is customary in the shops. Not that the job should develop into something "soft." On the contrary, the spirit of the organization, and hence the dignity of the work, will be greatly enhanced by stressing the value of character, by cultivating a certain pride of achievement in terms of accuracy and a rigorous demand for personal responsibility. All of these attributes should be tempered by a very obvious interest on the part of the chief inspector in the personal welfare of everyone in his department.

All parties gain by such consideration. High morale is absolutely necessary in the inspection department. Just as the accuracy of measuring instruments is fundamental in determining the degree of mechanical accuracy that may be attained, so must the inspection force's fidelity be developed to secure the predetermined standard of quality that is desired. Character is the first desideratum and as a part of it, impartiality, thoroughness, and accuracy in developing the real facts, and courage in bringing them to light. The chief inspector must train his forces to secure these results and then, lest he lose the advantage, he must back them up when they are right and must in turn be backed up by his superiors in the management. The inspection force should be disciplined to a strict obedience in carrying out the chief's instructions, if for no other reason than to secure a certainty of control in developing the standards of quality with freedom from disturbing influences arising outside of the inspection department.

A Purchasing Agent On Price Cutting

By Lewis A. Jones
President of the National Association of Purchasing Agents

I HAVE read your recent article entitled "Who Pays the Cost of Price Cutting?"* It is most interesting. I have a lot of things which I would like to say, but which are difficult to put on paper.

I have no grievance against the sales organizations of the country, but I have many thoughts based upon some sad experiences which I have discussed much and often with venders. Unless carefully expressed, they would carry, perhaps, an impression of a controversial attitude, which I want to avoid. This feeling is based simply upon the fact that I think the day must come when the purchasing agents of the country and the sales organizations will get together and study some of their mutual problems, in a definitely constructive frame of mind. This is as it should be, and this year, as president of the National Association of Purchasing Agents, I have had a definite plan to call together some of the leading industrial executives to discuss this very topic. So much for the preliminaries. I believe this article to be thoroughly constructive in its intended purpose. Of course, with a just amount of pride in my work, it hurts to have implications made against purchasing agents. I know all too well, however, that there are men in our work who do represent the attitude which you emphasize. These, however, I do earnestly believe are becoming each year fewer in number. Through our national association a vast amount of good is being done to recognize the ethics and economies of the problem.

There are about 8,000 concerns in the country, I believe, whose annual purchases amount to a million dollars or over and who may properly be supposed, therefore, to maintain central purchasing departments. There are nearly 5,000 men holding membership in our national association. About 60 per cent of every transaction is represented by purchase function, 20 per cent sales and 20 per cent executive. In the old days of barter, selling was recognized as the primary function, and in its activity was considered ahead of production and of purchasing. Of necessity, as the industrial picture expanded, sales took precedence over other activities in the minds of the public because of the prominence of advertising. Salesmen also were among the first to organize. The executives did most of the buying, and later, as industry developed, men or clerks were given the title of "purchasing agent." But they were too often designed by the executive not from the standpoint of efficiency but to give some man a job, or identify a certain part of his business, while he himself still really carried on the activities. There are still examples of this practice, too. The natural result was that sales organizations rebelled at being asked to deal with men having no authority, and in a very natural way were forced, in order to meet the requirements of their own companies, to go over the head of the so-called purchasing agent. Still being handicapped, they began to go into the shops and the factories, to see the foremen, and in every possible way to seek direct contact. In this respect purchasing agents themselves were to blame largely, because instead of working with these men they attempted to establish a position, a dignity and a name which they had not earned, and which the executives had not given them. Instead of working frankly and openly with the salesmen they antagonized them. This practice is still in vogue in many similar fields and is a "thorn in the flesh" of those men in the purchasing work who have a larger vision.

Because of all this, sales organizations have been and are in a great degree very antagonistic to the purchasing work. I well recall at one of our national conventions when a certain sales organization was asked to provide a speaker on our program, it hired an advertising man to

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> (b) The man so selected should exemplify all that is best in business ethics in his association with the sales department of other companies
>
> (c) Sales managers should insist that before they contact with a company their salesmen become intimately acquainted with its routine
>
> (d) Manufacturers and organizations of purchasing men should cooperate to meet this problem on a constructive basis"

*This article, by Earl Whitehorne, was published on page 329, Vol. 68.

come before us, and he spent the entire time allotted to him in telling us of all our faults, condemning all of our attitudes and emphasizing the high qualifications of salesmanship as against the evil practices of purchasing. Where we had looked for a constructive piece of work and a chance to co-ordinate our activities, we were only driven farther apart.

Sales managers today send men out on the road who are very poorly prepared. In my office, for instance, we interview many hundreds of men in the course of a month, and they are a most exceptional lot, I believe, in character and capabilities. And I find that in almost every instance where they are not prepared to give me the information and service which I have a right to expect when I grant an interview, it is almost entirely the fault of the sales manager or the executives back in the home office. My sympathy is completely with the man on the road, who, if his concern functions properly, should be to me the main point of contact and should represent his concern in all that is best of constructive thought, effort and service.

When you ask "Who is at fault?" each side will answer that the other man holds the crown. But as I have spent a great many hours in thinking about and discussing this problem, as I have met hundreds of purchasing men at our public utility meetings, at our national conventions, in their private offices, in community work, etc., I have in the last eleven years found a marvelous improvement in the caliber of purchasing men, and great anxiety for the improvement of the ethics of our work. We have a high type of men in every way. From among their number there are being selected today some of the highest executives of industry. For instance, A. L. Salt, for years purchasing agent of the Western Electric, is now the president of the Graybar Electric Company. There are many others. I do not in any way evade or overlook the methods of small caliber purchasing men, but you will find an equal number or more in the ranks of salesmen.

Both Parties at Fault

Who is most at fault, the buyer or the seller? I think it is at least a 50-50 break and needs only a Moses in industry to eradicate 90 per cent of the misunderstandings which exist today. This Moses, however, will have to improve the ethics of selling as definitely as he improves the ethics of buying, and I firmly believe that this can be done through a co-ordinated effort on the part of the executives, working with and through purchasing departments as definitely as they work with their sales organizations.

The trouble is that so many executives give the men the title of "purchasing agent" and then withhold the authority. And I can speak quite frankly here, because in my own work I think I have about the finest situation in this respect that any man could ever hope for.

Every transaction between a purchaser and a vender should be on a basis of mutual profit, benefit and satisfaction. Otherwise, sooner or later one or the other will be a loser. The best purchase work can be done on a basis of complete confidence. Three things must be considered: First, the quality of the article to be obtained to best fit the need. Second, the consideration generally covered by the misused word "service," which the vender will give to the purchaser's need. Third, price.

You emphasize the fact that we are now in a buyers' market and have compared activities of purchasing agents now to comparable activities of salesmen when there is a sales market. But even in a buyers' market such as we now have, a large part of the trouble, I firmly believe, is caused by the producing agencies themselves, a weakness which you have designated as "lack of price courage." For instance, a few months ago I had a special piece of apparatus to buy. It had to be made up. I asked for bids, and then one day the executive of one of the companies came in to see me. Recognizing the extreme pressure and competition which was on, I told this man that before I asked for my file of prices, which I had not checked through, I wanted to know whether or not he had given me what he considered an equitable price and the best which he had to offer, because I did not propose to "horse trade" with him. I wanted each man whom I had asked to bid to be given an equal opportunity at the business, and the fact that this man sat at my desk would have no bearing whatever in the final decision. He thereupon informed me that he had not quoted the best price, that he could reduce the quotation $300 and still make a profit for himself. Being thus assured, I was given the papers from my file, checked them and found that he was the only man who could furnish the material and the only one who had quoted.

I felt that, having his assurance that his revised price was legitimate and carried a profit, I was not unethical in accepting it. And he never knew that he had bid himself out of $300. This is a concrete example of what you term "lack of price courage."

Another Example

Still another case. A vender quoted me a certain price. It was one of the strongest buyers' markets that I have ever known, but I quickly realized that he was using me to get the last cent possible without being frank about the situation. In fact, he used many clubs and sticks, took much unfair advantage of our situation, pulled all the wires possible to make me pay a high price on a low steel market and finally, absolutely by his own activities, drove himself to the point where he sold me the equipment for $10,000 less than he originally bid.

In a contract which I am at present negotiating on a large scale for service in our entire territory a nationally known vender with whom I have had many years of well-established contact and from whom I have received very special consideration has in this instance, I now learn, adopted a definite policy of trying subterfuge. The contract submitted carried two or three "jokers," which they have acknowledged as having been intentional on their part. They have thus chosen to jeopardize a confidence which we had built up with each other over a period of probably twenty years. What should a purchasing agent do in a case of that kind? There is only one answer.

These are some of the faults perpetuated by venders. Again, however, the purchasing agents are to blame, as I see it, through failure to take advantage of their own opportunities. As an example: For some three years one of my assistants has been experimenting with a certain particular system of order writing. As the work has grown, it was necessary either to find ways and means to reduce the cost of writing orders or put on extra people. He developed a very simple and very economical method, and a few days ago the representative of a manufacturing company told us of this young man's activities and that the results which he had obtained by working so closely with it had opened up for his concern an entirely new field of endeavor. It was a work with

purchasing departments which the company had never suspected could exist, and it is going out now to cash in on that. This is simply and solely the result of the work in this purchasing department by a young man who had enough interest to study his job. This vender in showing his appreciation of this kind of co-operation stated that usually the purchasing agent he or his people called on refused to work with them, sent them to many other departments and so lost the value which might have accrued to them and the credit which would come in a constructive piece of work of this kind.

Well, what should be done to help the general situation? I think I have answered this question, but to emphasize a bit:

(a) Executives should not give a purchasing agent a title without the responsibility.

(b) The man so selected should exemplify all that is best in business ethics in his association with the sales department of other companies.

(c) Sales managers should insist that before they contact with a company their salesmen become intimately acquainted with the routine therein.

(d) Manufacturers and organizations of purchasing men should co-operate to meet this problem on a constructive basis with a real determination to eliminate the present misunderstanding. It can be done! And I hope to start the work through the auspices of the National Association of Purchasing Agents.

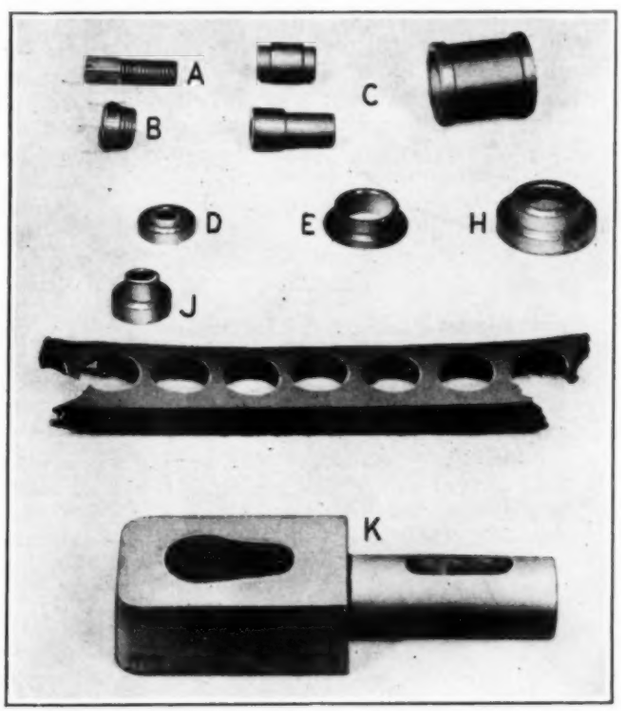
Tools and Speeds for Cutting Hard Fiber

By Fred H. Colvin

FIBER is being utilized more widely in the construction of machinery and other manufactured products. Fiber gearing has been used for many years, but many other parts are now being made both of fiber and bakelite compositions that were formerly made of metals. This growing use makes information as to cutting speeds and the tools used all the more necessary.

The parts shown in the illustration give some idea of the variety of uses and the different kind of operations required. These operations are, for the most part, confined to sawing, drilling, turning, threading and punching.

In machining both fiber and bakelite compositions, the tools seem to dull quickly. Saws at the plant of the Spaulding Company, Tonawanda, N. Y. run very fast, about 3,300 r.p.m. for 12 to 14-in. saws. The saws dull quickly but no other speed gives better results.



Examples of parts made from fiber by various machining processes. Some are turned and threaded, while others are punched and still others are upset or drawn to two diameters. There seems to be no difficulty in handling the material if care is given to the cutting tools

Turning speeds of from 600 to 800 ft. per min. give good results. The tools are ground in much the same way as for brass. They have no top rake and the chip should come off without much of a curl. Tools using diamonds for cutting have been tried and hold an edge well. The cost of regrinding, or lapping, and the time taken to send them away for redressing, made it seem better to use a high-speed steel, Rex A A or its equivalent being found very satisfactory.

Threads can be cut on fiber rods without difficulty and standard dies give very good threads at about the same speed as for brass. An example of this sort of work is seen at *A* and *B*. Regular machine tools are used for this purpose, small automatic screw machines handling fiber rods about the same as brass. All work is cut without lubricant of any kind. The group at *C* shows examples of screw-machine work. The tool leaves a very smooth surface and can be held to size quite closely.

In punching, as in other operations, fiber is handled in much the same way as metals. There is, however, a difference when it comes to allowances for the spring, or movement of the material. In punching holes for example, the fiber closes in after the hole has been punched, so that it is necessary to make the punch a trifle larger than the hole desired. For a 1-in. hole the punch should be made about 1.005 in. in diameter and the die correspondingly larger, there should be practically no clearance between punch and the die. For punching out disks, it is necessary to reverse the allowance, owing to the material swelling slightly after being punched. The diameter of a hollow punch for 1-in. disks would be 0.995 inch.

An unusual phase of punch press work at the Spaulding plant is the way in which the material is not only punched but also drawn or extruded. In other words the fiber is forced into dies of different diameters and upset, or formed, as at *D*, *E* and *H*. At *J* is a piece of fiber punched from a strip about $\frac{1}{4}$-in. thick. The hole is pierced and the small diameter is drawn at a single stroke of the press. At *H* is a considerably larger piece and the upsetting is even more pronounced.

The piece *K* is a good example of punching, both of the holes being punched at one stroke of the press. The round stem is turned and is very smooth. As an example of homogeneous material, it can hardly be excelled.

· BOOK · REVIEWS ·

AIRCRAFT HANDBOOK. By Fred H. Colvin and Henry F. Colvin. Four hundred sixty-four pages, 5x7½ in., semi-flexible cover. One hundred fifty-four illustrations. Published by the McGraw-Hill Book Company, 370 7th Avenue, New York. Price $4.

ON ACCOUNT of rapid changes in aviation within the past few years, the authors have revised the third edition of the Aircraft Handbook by adding numerous chapters dealing with features heretofore untreated and by omitting some information that has become obsolete. Revisions have been made to such an extent that the volume can be considered as a new book.

Starting with a chapter on airplane theory, covering such factors as the angle of incidence, lift, dihedral angle and stability, the book goes into the description of airplane rigging, the assembly of airplanes, factors concerning the design, construction and testing of propellers, problems concerning the design of airplane engines, and data pertaining to engine failures, principally in the form of trouble-shooting information.

In covering the construction of engines, the authors have prepared the individual chapters for several of the leading types in use, which include the Wright whirlwind, the Curtiss D-12, Packard engines, the Pratt & Whitney Wasp, the Liberty, the Curtiss OX and the Wright-Hispano. In each chapter is given a general description of the engine, operating features of the principal parts, such as valves, rods, and pistons, the lubrication system, installation recommendations, points on overhauling and other data of a pertinent nature.

The development of aircraft has been dependent to some extent on the perfection of instruments and a chapter dealing with their design and use is included describing such instruments as the tachometer, thermometers, oil pressure gages, fuel gages, altimeter, air-speed indicators, the magnetic compass, the earth inductor compass, and the drift meter. Air commerce regulations which are now in force are given, these including the licensing of aircraft, the marking of licensed and unlicensed aircraft, requirements in operation, licensing of pilots and mechanics, and air-traffic rules. Another chapter outlines suggestions offered by the Department of Commerce, Airway Division, for the construction of airports. This information will be of value to commissions planning airports and to others wishing a fundamental treatise on airport construction. A nomenclature for aeronautics, as arranged by the National Advisory Commission for aeronautics is included.

The book is recommended for owners of aircraft, aviators, mechanics and others whose duty deals with aeronautics.

SAFETY AND PRODUCTION. A report by the American Engineering Council containing 418 pages, indexed, 283 charts, 31 tables, 2 appendixes, cloth boards. Published by Harper & Brothers, 49 East 22nd Street, New York City. Price $5.00.

THE greater seriousness of accidents and their very evident increase in cost in recent years prompted the National Bureau of Safety Underwriters to request the American Engineering Council to make an engineering and statistical study, national in scope, of the comparative relationships between industrial safety and production. Apparently the seriousness of the situation is directly a result of increased industrial activity with its consequent increase in mechanization. It has been found that although the hazards have increased per man-hour, production per man-hour with respect to hazards has increased much more rapidly. It is agreed that even though there are fewer accidents to a given volume of production now, the great increase in accidents generally is alarming.

This report, which is an analysis of the reports of over 13,000 companies engaged in widely diversified industries and employing 2,400,000 men, contains answers to such questions as:

1. Can industrial accidents be better controlled under modern methods of production and if so, how?
2. Does safety work interfere with production?
3. Is the safest factory the most efficient factory?
4. Who is responsible for carrying forward the new safety movement?

The work is recommended to those executives who are interested in comparing their safety records with general trends within their own industry.

MECHANICAL DRAFTING HANDBOOK. By Frank R. Kepler, supervisor of industrial arts, Department of Vocational Education, Detroit Public Schools. One hundred and twenty-seven pages, 6x9 in., paper cover; 43 figures, 16 plates and 19 tables. Published by the Bruce Publishing Company, Milwaukee, Wis. Price 60 cents.

A COMMITTEE of the Michigan Vovational Education Society has approved this handbook for use in the secondary schools of the state. It provides students and mechanical draftsmen with a brief collection of data which have been criticized by representatives of more than fifty leading industrial concerns. The contents are divided into three sections: Part I, Lettering, Tools and Drawing Procedure; Part II, Standards and Conventions; Part III, Tables. Geometrical constructions are appended. The author has succeeded in presenting only material which should be helpful in making uniform drawings intelligible alike to engineers, draftsmen and mechanics.

LIGHT METALS AND ALLOYS. Circular No. 346 of the Bureau of Standards. Four hundred and three pages, 7x10 in., paper covers. Sold by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. Price $1.10. This book was prepared to meet a demand for systematic data on the properties of the light alloys that are now finding wide application in airplane and automotive engine building. It discusses the alloys of aluminum and magnesium, showing the effects which various elements have on the physical properties of alloys of these two metals. The book is largely a compilation of published material and reports of researches by investigators. Diagrams for the important alloys are included, and a large list of alloys with their compositions is also given. The matter of corrosion resistance and protection against corrosion, and the theory of the heat-treatment of light alloys, are discussed. A very complete bibliography appendix of published material on these alloys is also included, and covers 77 pages.

Tooling That Is Unusual

By Fred H. Colvin
Editor American Machinist

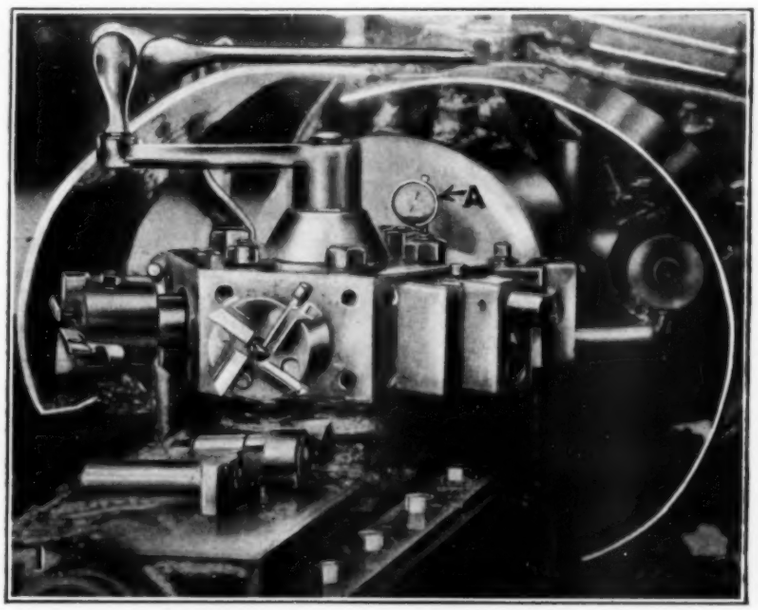
Some of the methods used in making the Houde hydraulic shock absorbers, including the use of dial indicators on turret lathes—Swaging splined holes to a taper

THE Houde shock absorber, made by the Houde Engineering Company, Buffalo, N. Y., consists of a body or reservoir that contains two stationary abutments and has two moving wings, each provided with a small valve through which oil flows slowly as the wings move from one position to another. The body or reservoir is made of steel forgings and is bored on the turret lathe shown in Fig. 1. The kind of boring tools used are shown and, of particular interest, is the use of a dial indicator to show the operator when the boring tools have reached the proper depth. This indicator is shown above the turret at *A*, in the operating position.

In order to provide an open space or clearance for cutting the abutment slot, it is necessary to first mill a space at the bottom of the case. This is done on a hand milling machine, as in Fig. 2, using an angular head and having the cutter in a horizontal position as shown. The type of chuck used and the quick-acting lever by which the case is clamped, can be seen. The case to be milled is put in place from the back side and is held against permanent jaws. The length of the cut is controlled by the stops shown on the front of the table.

Following the milling of the clearance, the dovetail slots for the permanent abutment are cut in a die slotter, as in Fig. 3. The cases are held in the substantial fixture shown, which can be readily indexed 180 deg. for the cutting of the second slot.

In the meantime, the wings, or the parts that move between the permanent abutment, are being milled on each end, as in Fig. 4. The revolving fixture holds two wings on each side. They are held in the notches at the bottom of the fixture and are drawn back against an abutment at the top by inclined surfaces on the upper jaws. The clamping is done by the large nuts shown, drawing an equalizing bar up under the back end of each of the



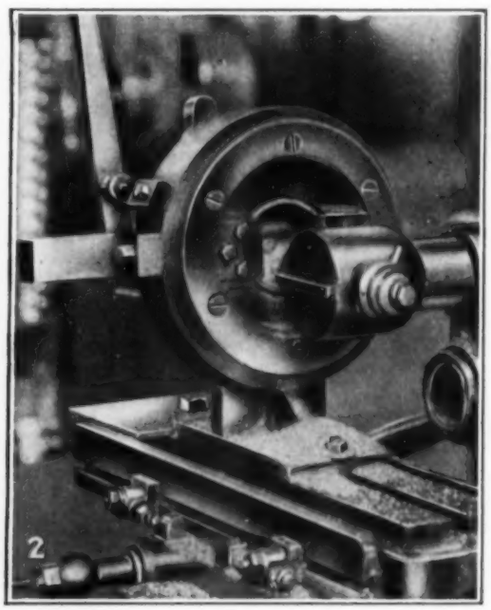


Fig. 1—Boring the reservoir case, or body, on a turret lathe. This view shows the type of boring tool used, which includes two four-bladed cutters and a single-point tool at the right. The dial indicator shown at A on the turret, is to enable the orerator to gage the depth of the bore very accurately, as the depth is very important. Fig. 2—Milling a clearance space for the slots that hold the abutments, or stationary wings. This clearance space is cut with a small milling cutter held on an angular spindle on a hand milling machine

Fig. 3—Cutting the slot for the abutments, or permanent wings, on a die slotter. The case, or reservoir, is located by its outside diameter, and is forced against a shoulder in the upper part of the fixture. The fixture is indexed 180 deg., and both slots are cut at the same setting

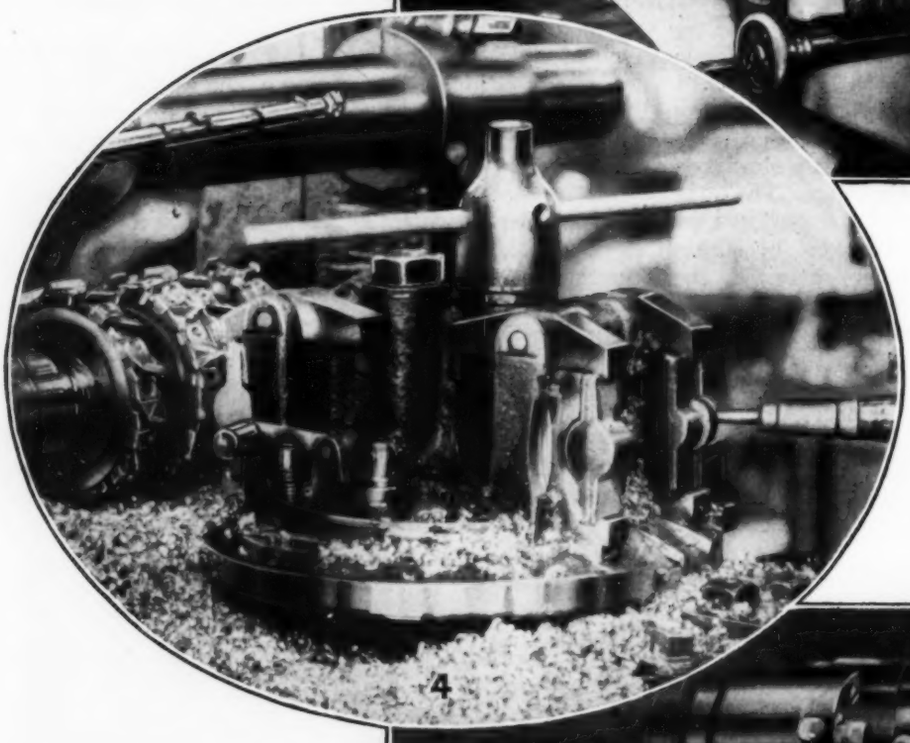


Fig. 4 — Straddle milling both ends of the abutments, or stationary, wings. The forgings are held in pairs by means of an equalizing lever and operates on the under side of the upper clamps. Large, widely-spaced inserted-tooth milling cutters are used, and the size of the chips indicates the feed that is taken

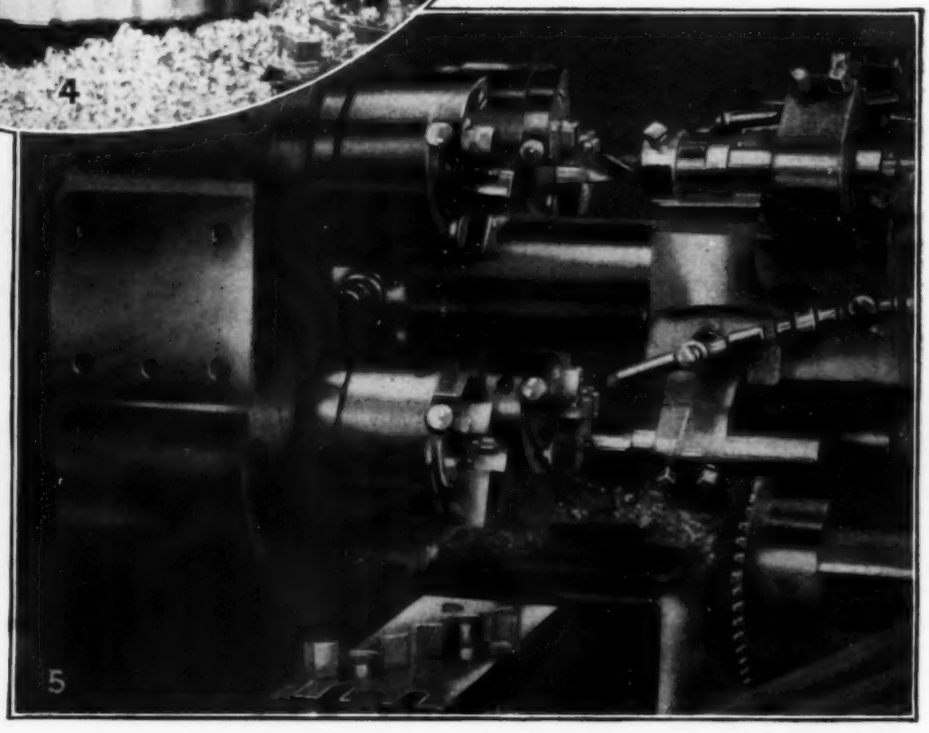


Fig. 5 — Counterboring the abutment on a four-spindle machine. A center hole is drilled through the abutment, and the hub is cut away on one side, as shown by the finished piece on the machine

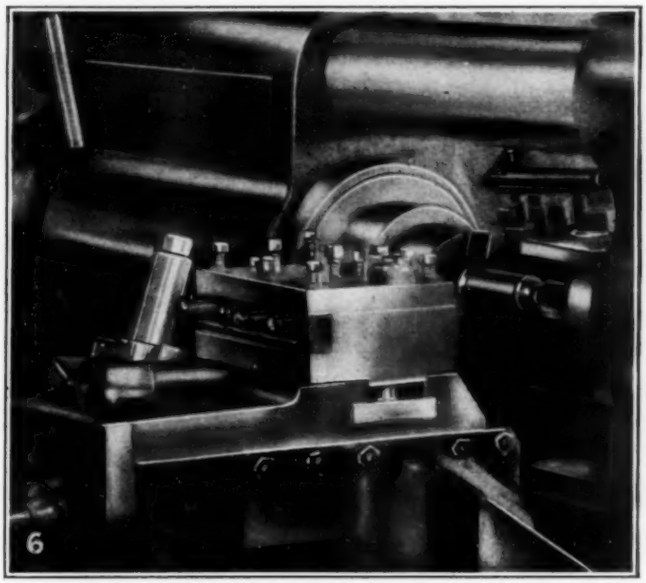


Fig. 6 — Rough turning the shaft on the movable wing. The Stub lathe shown is specially fitted with multiple turning tools. The shaft is afterwards finished by grinding.

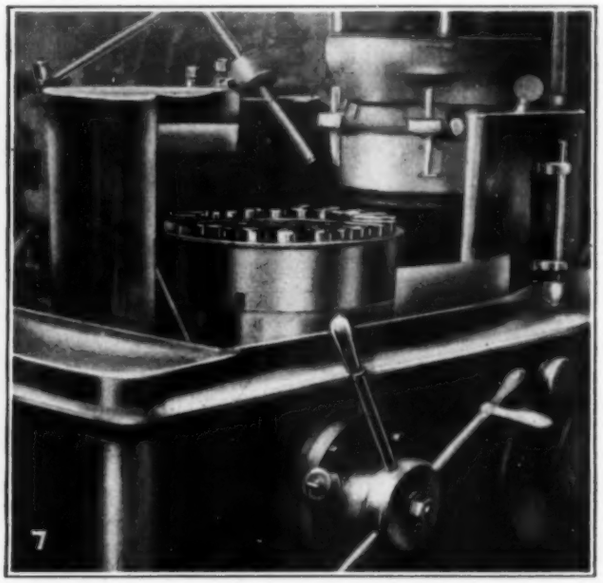


Fig. 7—Finishing the ends of the movable wings on a grinder. The shaft ends of these wings fit in the fixture shown. The other ends are finished within very close limits in order to insure a close fit in the case. This method secures accuracy at very low cost

clamps. The widely-spaced inserted-tooth cutters mill both surfaces very rapidly, as can be judged from the size of the chips.

Two of the stationary wings, or abutments, can be seen on the tool rest in Fig. 5. The one at the left has been counterbored to receive the movable wings, this operation being performed on the four-spindle machine, as shown. This view also shows the end of the stationary wings milled to fit the slot previously referred to.

Each movable wing has an extension shaft to which the arm that connects with the car axle is attached. The Stub lathe, shown in Fig. 6, is equipped with multiple tools for turning this shaft, which is afterwards finished by grinding. Following this operation, the ends are ground in a special fixture, as in Fig. 7. This machine surfaces the ends of the wings and secures an accurate thickness, which is very necessary to the proper operation of the shock absorber.

Holes for the regulating valves are drilled in the wing shafts in the fixture shown in Fig. 8. Each fixture holds four shafts, and the drilling is done from both ends. Each drill spindle drills half the depth of the hole, which is completed when the plate is indexed to the second position. One operator handles the two fixtures, and so helps to make the drilling cost very low.

After the body, or reservoir, has been completed, it is inspected by the tools shown in Fig. 9. The tools in the center check the diameter of the bore and its depth while the snap-gage at the left checks the outside diameter. The operation of the wings is tested by means of the

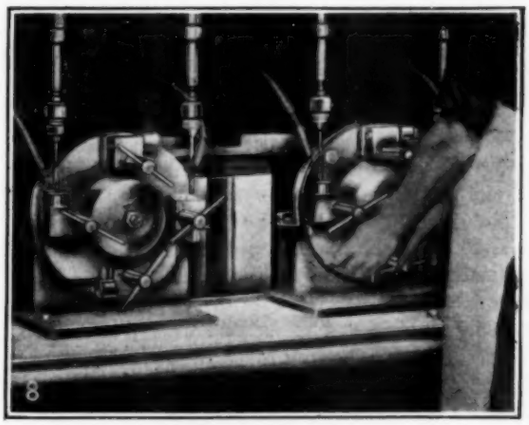


Fig. 8 — Drilling holes in the wing shaft. The fixtures hold four pieces, and are so arranged that the drill in each spindle drills half way through the shaft. The holes are completed in the second position. One operator handles both fixtures.

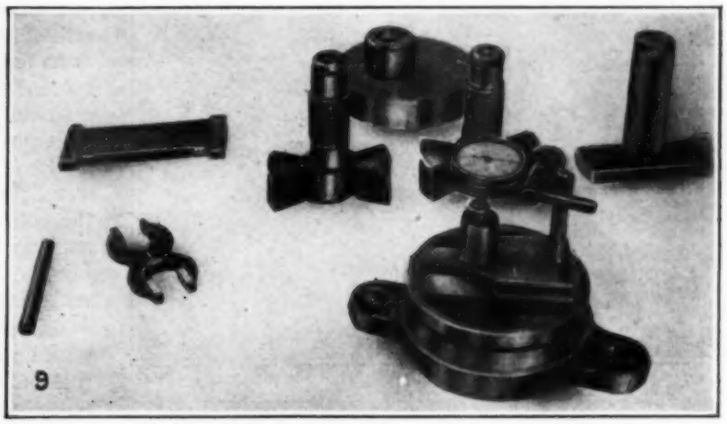
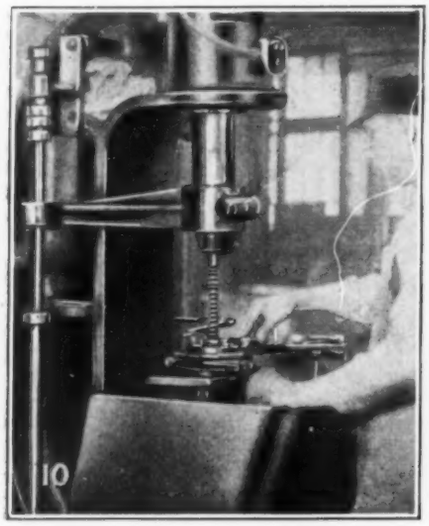


Fig. 9—Inspection gages used in checking the various dimensions of the body, or reservoir case. They include snap-gages for the outside diameter, and internal gages that resemble the movable wings. The gage equipped with the dial indicator is used to check the depth of the hole in the case, which is important



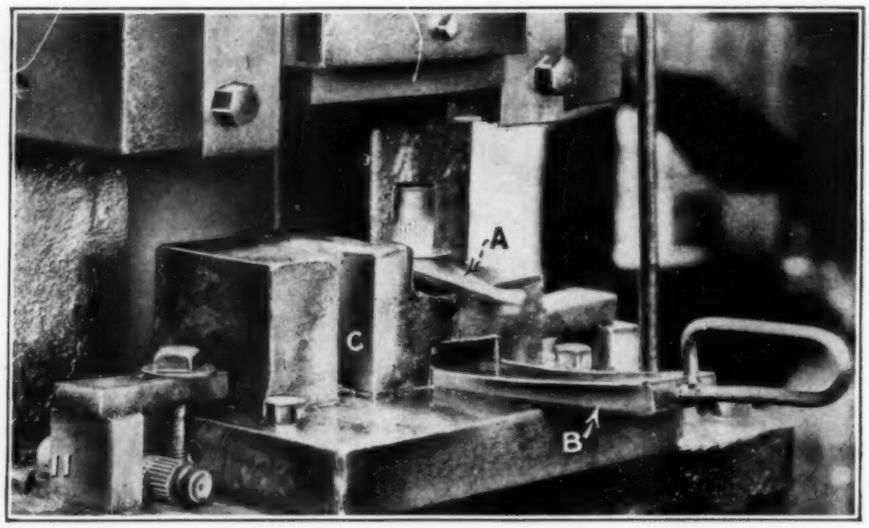


Fig. 10—Broaching splined holes in the operating shaft. The work is done on a broaching machine, and push broaches are used to broach the splines for holding the lever on the shaft carrying the movable wings. Fig. 11—Tapering the splines in the operating lever to fit the shaft. A taper plug is driven into the splined holes, and the holes are expanded at the upper ends. The wedge beneath regulates the advance per stroke of the plug

Fig. 12—Final test of the completed shock absorber. After being filled with oil, the shock absorber is put in place and is subjected to the same action as though on a car. The time required for the oil to pass through the valves is carefully checked by a watch. The load is applied by means of the weight at the end of the cable, which is wound up by means of the large handwheel

gages shown, and very close tolerances are held on all the dimensions.

Going now to the operating lever, we find the problem of making a taper hole with corrugations. This is done first by drilling, and then broaching the corrugations in the machine shown in Fig. 10. A push broach is used and leaves the hole with straight splines. To secure the desired taper, a hardened, tapered, splined-plug is used under a crank press, as in Fig. 11. The small end of the plug is entered in the broached corrugations, and the lever is placed on the support in the crank press, as at *A*, Fig. 11. The lever rests on a bushing that is moved vertically in the support shown by means of the wedge *B*. With the bushing supporting the lever resting on the thin end of the wedge, the press is started, and is so set that in this position it can force the tapered plug into the hole but a short distance.

After each successive stroke of the press, the wedge is pushed under the bushing and raises it, so that each stroke forces the plug farther into the lever. The wedge is so tapered that when it strikes a stop at the back, the splined hole in the lever has been tapered the desired amount, and the wedge is then withdrawn ready for the next piece. In order to remove the plug, it is necessary only to turn the lever upside down with the plug in the slot *C*, and the next stroke of the press forces it out of the hole. The operation is one of forcing or stretching, and has been found to be perfectly satisfactory in securing the desired taper and in holding the holes to size within the necessary limits.

After the shock absorber has been completed and filled with liquid, it goes to the testing machine, Fig. 12, where it is put under load and the time necessary for the oil to pass through the valves is checked by a watch. The load is given by the weight at the left of the machine. The weight is raised by the large handwheel, ready for the next test. Every completed unit is tested and adjusted to give the action that will be desired in controlling the car movement during service.

Whose Job Is It?

By Dwight Vandevate

A general statement of the possibilities underlying the analysis of executive jobs in the manufacturing plant

DURING the expansion of American industry in the past few decades there have been two developments which are very significant from the view point of management. The first is the great increase in the efficiency of direct labor, due partly to improvements in equipment and technique, and also to better management through job specialization, special training, functional supervision, and bonus and incentive plans of various kinds. The second development is the increase in complexity and size of the staff and supervisory organizations. The number of technical and supervisory positions has multiplied rapidly. While the efficiency of direct labor has been increased there has been no real corresponding effort to increase the efficiency of the staff and supervisory divisions. The results are apparent in many organizations in the form of overlapping and a lack of co-ordination and co-operation. Too many men in the supervisory positions have little real understanding of the specific duties and responsibilities of their jobs. To aid in solving some of these problems in management a program of job analysis has been initiated in some plants. The term job analysis has often become confused with hiring specifications. While hiring specifications are important, job analysis is a much more fundamental and far reaching proposition. The purpose of job analysis is to define exactly each individual's duties and responsibilities, give him a clear and definite understanding of his place in the general makeup of the organization, and at the same time give him the broadest possible conception of his opportunities. All of the activities of the organization are analyzed and co-ordinated, based on the individual and departmental job analyses. This latter phase is perhaps the more important. The initiating and development of a plan of job analysis depends largely on the individual organization. In general, it should be administered by a committee or individual, preferably the latter. Large organizations may be subdivided, placing an individual in charge of each section, responsible to the committee or individual in general charge. The scope of the plan also depends on the individual organization. The best results are obtained by first limiting the analysis to staff departments and individuals in supervisory positions (down to the grade of foreman or group leader) in the line organization. As the work progresses it may be found advisable to extend its scope. The activities of staff organizations such as engineering, sales, cost, and production divisions should be analyzed in detail, as a basis for the check on the co-ordination of all of their functions. The organization chart forms the basis for all job analysis activities, and the first step should always be to check this chart and make certain of its accuracy. The individual in charge of the job analysis work should act mainly in an advisory capacity, suggesting and directing as much as possible. Each individual should write up his job, assisted by the department head and the job analysis supervisor. It would obviously be impossible for any supervisor to be familiar enough with the details of more than a very few jobs to do any writing up of details himself. His task is to take the detailed write-ups submitted by the various individuals, edit and correlate them into a job analysis for the entire department. The analyses of the various departments should then be correlated for the entire plant

FOREMEN

Duties and Responsibilities

1—General

The foreman is the direct supervisor of his department. He is directly responsible to the Superintendent.

The foreman is the representative of the management in his department, and is responsible for the production of the best possible quality of work at a minimum cost.

It is a duty of very foreman to have corrected or to report to the management any infraction of rules, existence of unsafe conditions, faulty design or workmanship, or any other matter affecting the interest of the firm, known by him or coming to his attention anywhere, in or out of the plant.

The foreman is expected to concentrate on the *planning* of the work, insuring efficient plant operation by adequate preparation and instruction before jobs are started, and checking their progress until complete.

The foreman should see that the best possible working conditions are realized, both to promote safe and efficient methods of work, and cordial and harmonious industrial relations between men and management.

The foreman is directly responsible for the production, methods, and efficiency in his department. The Production, Methods, and Time Study Departments are responsible for the proper direction and co-ordination of their various functions throughout the shop, and require the hearty co-operation of the foremen, but this in no way relieves any foreman of his responsibility.

To approach the realization of the ideal shop towards which we are working will require the utmost from every man in the organization, and, in this endeavor, the management is depending on the foreman to be the key man.

Excerpt from a foreman's job analysis

or division. This last phase is the main task of the supervisor, and offers an unparalleled opportunity for checking up on the co-ordination of the organization.

Obviously, a man selected for job analysis supervision must have certain important qualifications. First and foremost, he must have a large amount of tact and good judgment. Second, he must have a thorough knowledge of the business in general, and third, he must have the confidence and backing of the management.

The results of job analysis work are important to all concerned. The individual is benefited by having a clearer and more definite conception of his job. To an ambitious worker such a conception is a spur to improved performance. The benefits to the organization are numerous. The definite placing of responsibility is of the utmost importance, both to management and worker. Job analysis shows up overlapping or lack of co-ordination between departments, weaknesses in supervision, and other organization deficiencies. A lack of co-operation within or between departments will always be apparent. Obsolete or unnecessary systems or records can be eliminated after job analysis has made their uselessness apparent. Another important possibility is the discovery of the necessity for training. There is no better basis for a training program for foremen or other supervisory workers than an analysis of their functions.

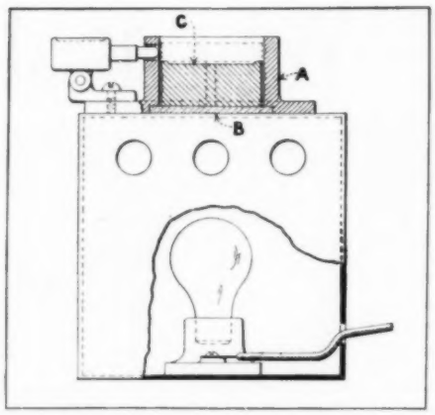
Lastly, job analysis provides a measure of performance of supervision. When the objectives of a job are once determined and defined the measurement of supervisory efficiency is simplified. This phase of the work is especially important to management.

The Inspection of Piston Rings

By Sydney French

THE inspection of piston rings, both from a mechanical and metallurgical standpoint, is one of vital importance toward the proper functioning of all types of internal combustion engines, yet it is a surprising fact that much laxity exists in determining the standards of their acceptance. In order to secure as near to a perfect joint between the piston and the cylinder wall, the rings must be free from distortion. This defect is one of the many difficult features to control in an attempt to achieve the ideal.

To simply confine inspection within the narrow limits of a check as to mechanical accuracy is insufficient. Elasticity and freedom from pin holes and porous spots, is very essential. Also a perfect ring must be free from the "hump" that is so often found in the region around the slot after it has been cut through. It is recommended that rings be made from close-grained iron that is slightly lower in silicon and higher in sulphur than is the mixture used for cylinder material, as it is harder and more elastic and the rings will wear quickly to a mirror-like surface when working in contact with the cylinder wall. Another point in favor of such a combination is the fact that metals of a like nature do not wear well together, the two dissimilar irons making a better surface.



Gage for inspecting piston rings

The fit of piston rings is vital to the power developed by the motor and in order to thoroughly inspect them for cylindrical accuracy it is essential to submit them to a "light" test. The gaging fixture illustrated has proved its merit for checking cylindrical distortion, also for affording means whereby the error can be measured instead of leaving it to the inspector's judgment.

The gage *A* is mounted on a steel box, at the bottom of which is an electric lamp. A disk of ground glass *B* for diffusing the light, is placed in a recess in the bottom of the gage and over an opening in the top of the box. A plug in the center of the gage has clearance slots to allow light to pass between it and the inner wall of the gage and also acts as a base on which to rest the ring to be tested. Outside of the gage, with its contact pin projecting through a hole in the wall thereof, is a dial indicator. By looking down upon the ring, any inequality in its roundness will be apparent by light rays passing between it and the interior wall of the gage. By the same token, the amount of inequality can be measured by revolving the ring while the contact point of the indicator bears against it. The box should be provided with holes to allow the heat from the lamp to escape.

Spiral Bevel Ring Gears

Their Machining and Heat-Treatment

In the manufacture of gears for an automobile, probably no gear presents as many problems, nor requires more care, special machinery and rigid inspection in its production than the rear axle ring gear.

In next week's issue C. S. Morgan, metallurgist of the Chandler-Cleveland Motors Corporation, will describe Chandler-Cleveland methods of heat-treating and machining the spiral bevel ring gears used in the Chandlers. This article contains all the details of the heat-treatment of the special S.A.E. 2315 steel used.

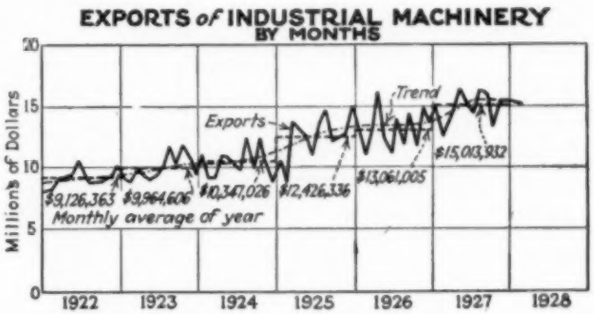
Activity in the Metal-Working Industry

Decrease Indicated During March

That the close of the first quarter of the year showed a rate of operations in the metal-working industry higher than that reported for the same period last year is indicated by preliminary data on electrical energy consumption received from a large number of plants. These reports indicate, moreover, that the peak of activities in the metal-working plants was reached in February, all of the energy consumption reports except those from the automobile industry giving lower figures than those of February, notwithstanding the fact that March had three more working days than February.

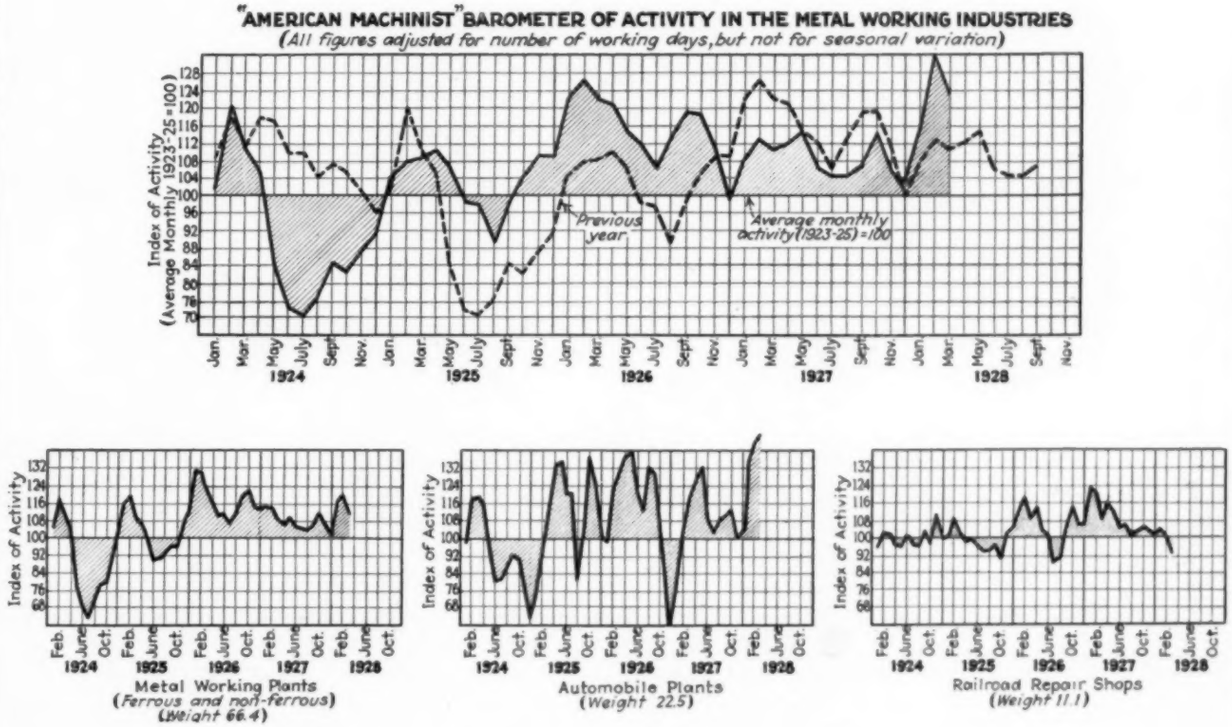
It was hardly to be expected, however, that the industry could long maintain the high rate of operations reported for February, a rate about 20 per cent above that of same month last year and 30 per cent higher than the low point recorded in December. The indicated decline in operations in March still leaves the industry operating at a rate about 11 per cent higher than March of last year. The rate of operations for the first quarter of the current year was apparently about 14 per cent greater than for the same period of 1927, and about 4 per cent higher than for 1926.

Exports of industrial machinery for the month of February, according to figures from the United States Department of Commerce, were about the same as for the preceding month, but showed a substantial increase



over the exports for the month of February, 1927. The largest increases have been in the metal-working machinery group, and the exports of this class of machinery for the first two months of 1928 were 50 per cent ahead of the quantities exported during the same period of last year.

The total of industrial machinery exported during February amounted to $15,054,000, of which metal-working machinery accounted for $2,373,000. There was a sharp decline in the exports of oil-well and oil-refining machinery, but gains in construction equipment and textile machinery. The gain in the latter item indicates a consistent improvement in the market after a period of decline.



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· TECHNICAL · ABSTRACTS ·

The Race Between Production and Distribution

There is practically no limit which can be set for the consumption of goods when production, distribution and purchasing power are properly balanced.

Foremost among these demands is that all who participate in industry shall receive a proportionate share in the results of our increasing efficiency. Management can have no quarrel with this policy since, as far back as adequate records go, this has been the practice of the manufacturing industries. Thus during the past quarter of a century our census reports show that the wage earner has received on the average of 41.4 per cent of the value added by manufacture. Briefly, since 1899 the value added to manufacture per wage earner has tripled and the income per worker has increased in the same proportion. The conclusion is that the producer is also the consumer.

A visible sign that production and distribution are in unbalance is provided by the unemployment situation which persists whether it is of normal proportions or not. It has been brought about in part by overproduction in some lines, and it may be the combined results of increased plant efficiency and insufficient markets. Our rapid progress has made very difficult the adjustment of these factors. As the production speeds up and expands, the distribution system must likewise reach out for new economies and broader markets so that an efficient balance between the two may be maintained.—C. S. Ching, *Management Review,* April.

Heat Treatment of Non-Ferrous Metals

During annealing processes, softening takes place over a wide temperature range in the heat-treatment of non-ferrous metals, and it has been established that properties other than hardness of the metals are seriously affected if the furnace temperatures are not held within certain limits. For example, the best annealing temperature for copper is between 450 and 550 deg. C. (842 and 1,022 deg. F.). Annealing at higher temperatures results in excessive oxidizatin of the copper and also poor ductility, which is undesirable if the metal is to be used for deep-drawing purposes. Nickel and monel metal should be annealed between 850 and 900 deg. C. (1,562 and 1,652 deg. F.). Annealing at lower temperatures is not practical from a commercial standpoint on account of the long time required. Higher temperatures result in excessive grain growth and low ductility. Even at 900 deg. C., it is necessary to control the annealing time to prevent grain growth.

Non-ferrous alloys may be hardened and the other physical properties bettered by proper heat treatment. For example, a copper-beryllium alloy has been developed which can be hardened and strengthened by heat treatment so as to give an elastic limit of 180,000 lb. per sq.in. and an ultimate tensile strength of 210,000 lb. per sq.in. It is very important, however, to maintain a close furnace control for heat treatment of these alloys. The process which takes place in the heat treatment for hardening is a formation of a solid solution at certain elevated temperatures, retaining this solid solution by more or less rapid quenching and then formation of submicroscopic hardening particles by ageing at certain temperatures. The range of temperature which may be employed for such a process is comparatively narrow.—James Silberstein, *Fuels and Furnaces,* March.

Japanese Market for American Machinery

Due to handicaps under which agents for American machine tools labor, sales of foreign machine tools have been declining in Japan. Japanese manufacturers now are making practically every line for which there is a demand, such as shapers, lathes, planers, milling machines, woodworking machines and the more simple machines of every kind. The workmanship is not up to that of American machinery, but in most coses it is quite good enough.

"If I were equipping a factory in Japan," said the manager of an important importing house which does a good business in machine tools, "and if the present differential between American and Japanese prices existed, I would use Japanese tools for the rough work and import American machinery for the precision work.

"However," he continued, "the present differential is needless. Exporters would get more business here, and their eventual profits would be larger if they would charge prices which would cover their production costs plus profits instead of straddling us with their American advertising and merchandising charges.

"If American manufacturers were to give us the discounts which they could well afford, we would be able to sell most of the products which we have been forced to abandon. Practically the only exceptions would be the very heavy lathes and planers for which freight runs to such a large figure."

Manufacturers abroad sometimes lose sight of the fact that Japan has long since passed the kindergarten stage in the use of machines and machine tools. Too often they look upon this as a field into which they may dump the out-of-date machines that no longer can be sold in the United States. With regard to machine tools in particular, the Japanese are perhaps the most studious buyers in the world. They read trade magazines and catalogs continuously, and they know what the latest developments are.—*The Japan Advertiser, Annual Review (Tokyo),* March.

Coil Spring Specifications

In ordering helical open-wound compression springs the kind, shape and size of wire should be specified, though the latter may be approximate and incidental to the load test, being left to the judgment of the manufacturer. When specified, the wire size should be given in decimals. The style of the ends, whether plain, plain ground, squared only, or squared and ground, should be made clear. Give the maximum allowable outside diameter of the spring, or give the hole size and desired clearance. Give the minimum allowable inside diameter of the spring, or give the rod diameter and desired fit. Also note whether the spring is to be wound right or left hand. Springs produced on automatic machines are usually wound left hand.

Specify the finish, whether plain, tumbled bright, blued, japanned rust-proofed, plated or galvanized. Check the following specifications: What is the desired strength of the spring? What are the weakest and strongest springs acceptable in terms of pounds of load for any given deflection? What is the assembly and working range of the spring? How many times per minute is the spring compressed? Are the loads gradually or suddenly applied? Is the temperature surrounding the spring abnormal? Are the springs subject to corrosion? (These last two factors are of vital importance in determining the kind of material to be used).

For helical close-wound extension springs, the same specifications in regard to material and finish should be observed. In regard to type, there are innumerable kinds of special hook and loop ends, dimensions and shapes of which should be carefully given. A description of the method of fastening should be included where possible. The number of coils and the direction of winding should be specified, and the length overall. It is important to know the initial tension—that is, the load the spring is expected to sustain before the coils open or the spring elongates perceptibly. The scale of the spring, or the load to be carried at any given extension, should be specified, also the range of deflection and the number of deflections per minute, as well as the maximum stretch the spring must withstand without , setting. — *Machinery,* March.

IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Forming Cylindrical Sleeves

By Frank Waldo

In forming cylindrical sleeves from flat material, it is often difficult to produce a shape that will join uniformly at the seam. This condition is due to the so-called spring in the material which causes an opening, or gap, to remain between the two ends after the forming operations have been completed. While this might not be objectionable in all cases, it was found to cause difficulty in succeeding operations.

By making the blank corrugated, as shown at *A* in Fig. 1, the result is that the extra stretch of the metal causes it to remain in a cylindrical shape in the final forming operation. The sleeve is made from ¼x5-in. strip steel and is formed to 5 in. in diameter.

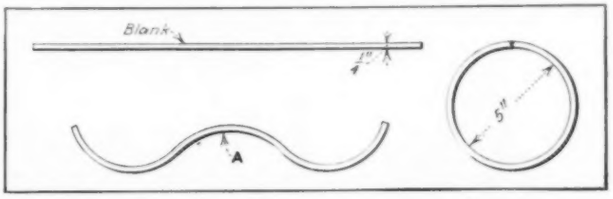


Fig. 1—Method of making cylindrical sleeves so that the ends will join uniformly

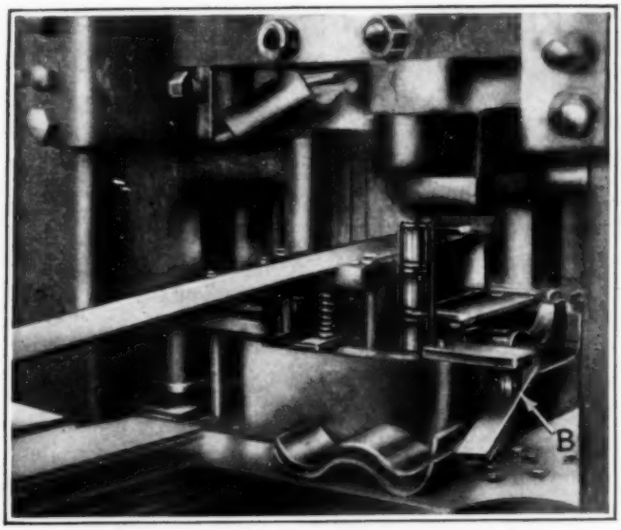


Fig. 2—A combination blanking and forming die used in making cylindrical sleeves

The die that cuts off the blank and completes the first form is illustrated in Fig. 2. The strip from which the blank is made is shown in position for cutting. The blank drops on a plate located about 3 in. below the cutting edges, and then is transferred to the right-hand section of the die where the first forming takes place. Shifting the blank to the forming position is done by means of a sliding finger that strikes the left edge of the blank. The finger is operated by means of the lever *B*. The same motion causes the blank to eject a formed piece from the die, so that the operator can remove it without having to stop the press. Examples of formed blanks are shown at the front of the die. In the next operation, the center hump is formed in the opposite direction, which brings the two ends of the sleeve together, thus forming a cylinder.

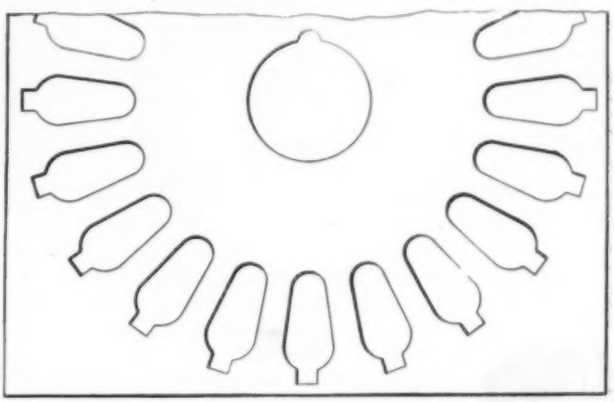
A Method of Laying Out Punches

By Charles T. Moehring

In making press tools for armature laminations, the die is generally finished first and is used for laying out the punches by scribing them through the openings.

In the die illustrated it was found impossible to lay out the punches in this manner, due to the sharp corners in the openings, so the following method was adopted: All the punches except the one in the center, were ground so that their ends were in the same plane. The punch in the center was finished to fit the central hole in the die and was left somewhat longer than the surrounding punches.

With the punch plate resting on parallels, the ends of the punches being uppermost, the die was placed face down on the punches, the punch in the center being entered into the central opening in the die. In this position the parts were clamped together, bringing the ends of the punches into close contact with the face of the die. With a piece of wood that had been whittled to a sharp point, two or three drops of etching acid were dropped into each die opening and spread around so



Die for armature laminations

that the acid reached all the edges and corners. In about five minutes the clamps were removed and the die was washed in hot soda-water to neutralize the acid.

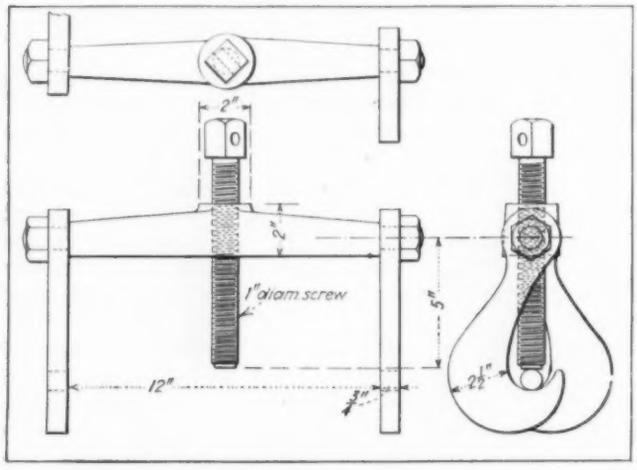
The acid on the punches was absorbed by sopping them with a soft rag, care being taken not to rub them with the rag. When the punches were thoroughly dry, oil was put on them and rubbed in. Spots corresponding to the die openings were found to be etched on the punches in dark brown. The outlines were clear and sharp and the etching was about 0.001 in. in depth. The punches were machined to the etched outlines, being left enough oversize to allow them to be finished by the usual method of shearing them in the die openings.

A Handy Shaft Straightener for Light Work

By H. L. Wheeler

The illustration shows a design for a rapid shaft straightener for straightening shafts up to one inch diameter in the lathe. By its use, straightening can be done faster and more conveniently than by the bar and pry method, and it will pay for itself in a short time in shops where much of this class of work is done.

The beam and hooks are steel forgings. The hooks swivel on trunnions that are turned at each end of the beam,



Shaft straightener for light work

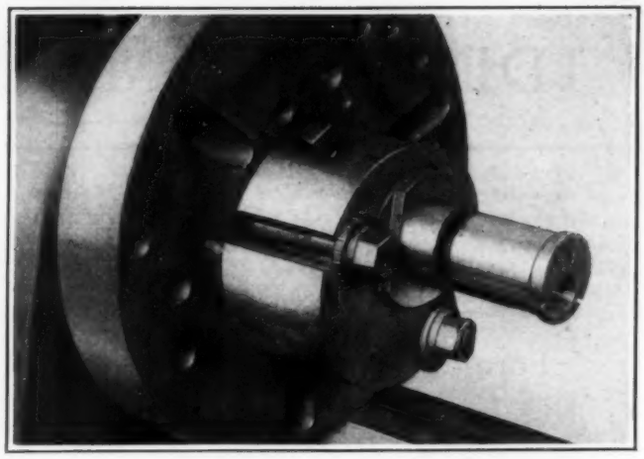
and are held in place by ⅞-in. hex nuts. A central screw, 1 in. in diameter, provides means for exerting pressure on the shaft, the pressure being opposed by the hooks.

In use, the shaft is indicated in the usual way for high spots, and after they have been marked, the straightener is hooked onto the shaft in a position to allow the screw to come in contact with the high spot.

Making Eccentric Bushings

By O. S. Marshall

Making special eccentric bushings, such as are frequently required in machine shop practice, is not always a simple procedure, particularly when precision is demanded. To overcome this difficulty, the following scheme has been successfully used several times by the writer. The illustration presents the idea clearly. To cover the average requirements, have two or three blocks



Block used in making eccentric bushings

of steel of various diameters, and bored to different sizes of standard holes, such as 1½, 2 and 2½ inches.

The flat faces of these blocks to be finished from the holes, square and parallel, for holding against the lathe faceplate. Make two generous slots in the blocks at opposite sides for the bolts that are to clamp them to the faceplate. The holes in the blocks should be bored a liberal offcenter distance. When a bushing is to be made with an eccentric hole, use sufficient length of stock, the shank of which will be used as a holder, turned to fit the hole in the block used.

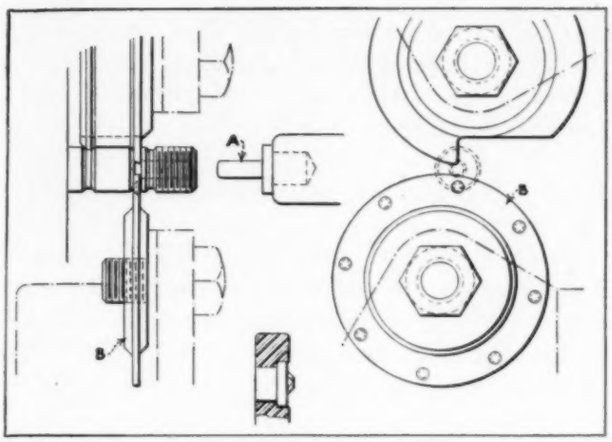
If the bushing requires hardening and grinding, a locating scratch line on the shank should be made, with a reference line on the block, to aid in replacing the bushing correctly for grinding. An indicator used for truing the work, also for determining the exact amount of eccentricity of the hole with the outside, will insure accurate results.

Rear-Face Stamping Tool for an Automatic Screw Machine

By Henry Simon
Jena, Germany

We had an order for a large number of bushings, threaded inside and outside, and in their general shape like the one shown in process in the drawing. The outer forms of all bushings were alike, but there were eight kinds, differing as to outside and inside threads and thread combinations, and for this reason the order specified that each bushing must have an identifying number stamped upon it. As there was not room enough on the outer end, because of the chamfer of the hole and the outside thread, it was necessary to do the stamping upon the head face. This rendered it impossible to use a turret end-stamping tool and accordingly the stamping was done in a second operation. Varous reasons, however, chief among which was the ever-present uncertainty as to whether the bushings had been stamped with the right number, emphasized by occasional mistakes in misstamping a few bushings, induced the writer to devote further thought to the question of stamping the bushings right on the machine. The result was the combination cross-slide and turret-stamping process illustrated in the drawing.

By this method, the turret is equipped with a shank bearing the hardened tool-steel receiving stud *A* having a flange about the size of the bushing diameter, and a



Tool for stamping in the automatic screw machine

body that freely enters the threaded hole in the bushing being made. The rear cross-slide carries a combination form- and cutoff tool. On the front cross-slide is mounted the stamp-holder disk *B*, made in the general form of a circular cutoff tool and bearing near the periphery the eight different stamps required. Each stamp is in the shape of a small, flanged stud and is a light force fit in its seat in the holder. The total thickness over the flange of the holder and figure is just slightly less than that of the cutoff tool.

The cams are timed so that as soon as the cutoff starts, the turret advances the receiving stud into the product until about $\frac{1}{32}$ in. is left between it and the flange on the stud. As soon as the cutoff is finished, the spindle is stopped. The stamp holder advances into the gap just as the cutoff tool backs out, and a moment later the turret advances slightly for the fractional part of a second, pressing the product against the figure. As the stamp holder backs out, the spindle starts and the turret indexes, dropping the product.

This method of stamping was considered superior, even though there is a loss of a couple of seconds, due to combining the cutff and form in one tool. This loss, however, is more than offset by the handling saved and the uncertainty avoided, the actual stamping itself requiring about the same time as by hand. On machines having a separate cutoff slide, this loss of time would of course not occur. Inspection of the numbering is confined to seeing that the piece is legibly numbered, except at the beginning of the run, when the first pieces are checked up to make sure that the operator has set the right number. Changing from one number to another is a matter of a few seconds, and all the numbers are always together and at hand.

The following pressures and stamping depths are, for stamping in brass, for an impression having 1 in. of combined length of outline:

Depth	Pressure
0.003 in.	750 lb.
0.004 "	1,800 "
0.005 "	3,500 "
0.006 "	6,000 "

The working turret-pressures for the Nos. 00, 0 and 2 B. & S. machines may be assumed as 250, 400 and 600 lb., respectively. As a good legible figure can be produced by stamping to a depth of 0.004 in., a total combined length of outline of about 0.125, 0.200 and 0.300 in., respectively, can readily be stamped on the three sizes of machine mentioned.

Practical Shop Problems

Questions of a practical nature will be answered in this column

Working More Than One Shift

Q. Our firm has received some large orders from an automobile company, and our automatic screw machine department is running 23½ hours per day. Our regular foreman takes the 11½-hr. day. He says that it is too hard on the machines to run continuously, and that they should have some time in which to cool off. We would like to have your opinion.

A. We doubt if it will do the machines any harm to run them as continuously as you are doing, provided that they are lubricated properly at intervals. The fatigue of metals is directly proportional to the working time, and to the severity of the vibrations or blows received. Fatigue can be relieved by heat-treatment, but it is questionable if the fatigue of the metal in a machine is relieved merely by idle time, especially by short periods.

During the war machines were run in some plants continuously for months, not shutting down even for the five-minute period allowed the workmen for washing up before quitting time. The machines naturally will not last as long in terms of months or years, but in value of production they will pay for themselves within a shorter period of time, and the reduced "overhead" will also be a considerable item.

If you can settle satisfactorily the matter of supervision, so as to place responsibility over the two shifts, and avoid excessive losses from scrap and broken tools, we doubt if you need to worry about the machines. The only other point is in the efficiency of the personnel, as it is fairly generally conceded that it is impossible to obtain the same efficiency from night workers as from the day shift. This is corrected by having the hours arranged so that a night man works only half of the dark hours, or by frequent changing about of the personnel of the two shifts.

Control in Heat-Treating

Q. In production heat-treating of parts that are to be quenched at 1,575 deg. F., within what limits of temperature is it practical to hold the furnace? We are using a gas-fired type of furnace with standard pyrometer equipment.

A. Under average conditions we would say that you will be dong well to hold the temperature within a range of 10 to 20 degrees. It is certainly possible to better this, but in practice there are many variables with respect to furnace conditions that influence the temperature changes. In the first place, if the furnace is not large enough in proportion to the weight of the metal being heated there will be a considerable cooling down when the charge is put in. This will necessitate longer time in the furnace to bring the temperature to the required point. Moreover, if the furnace is small for the work there will be a relatively large amount of "coasting" of the temperature after the action of the control. It is important, therefore, to have a furnace with ample capacity, and designed for the work, and to have the thermocouple properly placed. Under favorable conditions temperature limits as close as plus or minus 2 deg. have been held.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Time to Think

HOW often do you take time off to think? That question isn't so silly as it sounds. The executive's job—or part of it, anyway—is to think out plans for conducting the work assigned to him, whether he be department foreman or corporation president. But how much time does he give to that important function? And how much to the importunate little routine matters that keep bobbing up every few minutes?

Look over your own accomplishments during a given week. Did you have time to do any real thinking or were you too much engrossed with details?

It is probably safe to say that any executive job involves enough detail to occupy a man's full time. If he is going to do any planning, therefore, he must either shed some of the routine, or else keep on with the routine and do his thinking after hours when he is tired out by a long day's work. The first expedient is worth trying.

Unemployment and Efficiency

STABILITY of employment is unquestionably one of the most important factors in securing co-operation and efficiency in any plant. This was strikingly illustrated in a recent talk by Otto S. Beyer, Jr., who played an important rôle in organizing what is known as the Baltimore & Ohio plan of co-operation between the shop craft union and the railroad.

The plan was first tried out in the shop where poor equipment, lack of sympathy and uncertainty as to employment were factors in making it the hardest place of the system in which to try the experiment. A survey of the situation resulted in procuring a little new equipment, in an agreement on the part of the men to reduce the time of repairs, and on the part of management to repair all locomotives of that division in their own shop instead of contracting with outside shops, in order to insure steady work.

The combination of the various elements, in which the assurance of steady employment was perhaps the most important factor, worked out so successfully that the same plans were introduced in the other shops of the system, at the request of the men, and are still functioning to the satisfaction of all concerned.

While few manufacturing concerns can guarantee continuous employment to as great an extent as the railroads, it is easy to see how this factor has so much influence on the worker. If increased efficiency means a lay-off at the end of a contract, there is little incentive toward maximum effort. No one likes to work himself out of a job.

Unfortunately we know of no panacea for unemployment. Many farsighted business men believe that much can be done to prevent the extreme peaks and hollows that now show on too many business graphs. If business managers will consider unemployment as a business problem, we shall progress toward at least a partial solution.

Specialists in Heat-Treating

SPECIALISTS are the subject of much discussion and controversy. Unhappy experiences have led some to decry them all. But there seems to be little doubt as to there being many fields in which specialists are a great boon to industry. One of these fields is in the heat-treating of metals.

Heat-treating is being used more and more on such materials as cast iron, cast steel, sheet metal stampings, and aluminum-alloy sheets and castings. In some plants, all fragile castings are heat-treated to remove internal strains before being machined.

Even in the day when tempering carbon steel and case-hardening wrought iron and soft steel were about the extent of the steel-treater's art, certain men and certain shops secured the best results. With the much more complex problems encountered with steels alloyed with various metals, and in different proportions for different purposes, the specialist in heat-treating has become indispensable.

In various parts of the country there can now be found small, well-equipped heat-treating plants in which no other kind of work is attempted. These, as a rule, begin by serving local interests only, but if they are really good their reputation seems to spread until they receive work from shops, some of them large, within a radius of a thousand miles. Results that will induce large concerns to send their work to small, highly specialized plants, cannot be questioned. Such specialists are needed and are here to stay.

Goss & DeLeeuw 11x10-Inch Multiple-Spindle Chucking Machine

A MULTIPLE-SPINDLE chucking machine of the tool-revolving type, which retains the principal features of an earlier machine built by the same company but is of greater capacity, has been developed by the Goss & DeLeeuw Machine Company, New Britain, Conn., and is now available to the market. Fig. 1 shows a front view of the machine. It is capable of handling work-pieces up to 10 in. in diameter, and the sliding turret has a maximum range of movement of 10 in. to and from the tools.

Four active spindles carry tools for drilling, boring, reaming, turning, facing and threading operations upon castings and forgings. Pieces of any shape and size within the capacity of the machine can be held in either standard universal chucks having two, three or four jaws, or in special holding devices, which are secured to the vertical face of the turret.

The turret indexes to five positions about a horizontal axis that is parallel to its line of travel, thus providing one idle position in which to unload and reload the chucks or other holding devices. Opposite to and in line with the idle position is a hand-operated, though otherwise stationary, spindle that assists in centering the work.

The movement that presents the work to and withdraws it from the tools is actuated by a cylindrical cam that is inclosed in the slide. The active members of this cam are half-cylinders of hardened steel in which the contour is cut as a groove. They are easily removable, and others of different contour may be substituted to obtain other combinations of fast and slow movements.

The stationary cam-roll is mounted on a separate member that is locked rigidly to the bed while the machine is in action. It is provided with a screw-actuated micrometer adjustment to accurately locate the extreme forward position of the slide when setting up the machine for work that involves facing cuts.

The turret is indexed by a modified form of the Geneva movement that is inclosed by the housing of the slide directly behind it, and is so interlocked with the feeding movement that indexing can take place only when the feeding cam is out of action. The locking bolt engages an indexing plate which is a part of the turret itself; its locating notches being disposed in a circle of greater diameter than that in which the work and spindles are arranged.

A clamping device covering nearly the full diameter of the turret holds the latter rigidly while the tools are at work. All movements having to do with clamping and indexing the turret together with rapid advancement of the work to the tools are controlled by cams which are mounted on the main cam drum and independently adjustable thereon. Any part of the machine may be taken down for repair and reassembled without fear of throwing the cycle out of time.

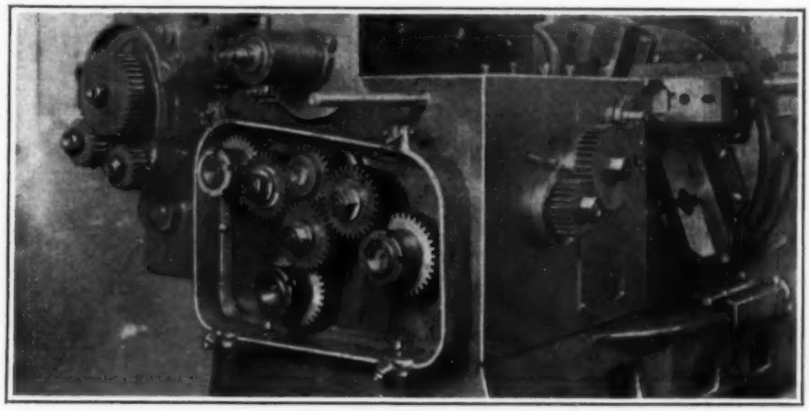


Fig 2—Change gears governing speeds and speed ratios of spindles

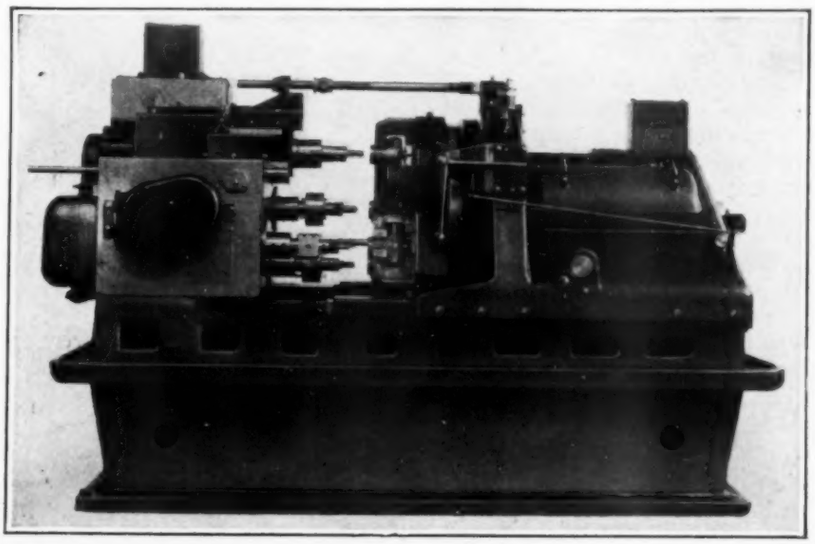


Fig. 1—Goss & DeLeeuw 11x10-Inch Multiple-Spindle Chucking Machine

The active spindles are driven through a train of gearing so designed that by changing a pick-off gear in an inclosed gear box the rotative speed of all spindles, except the threading spindle, may be changed as a unit. Also by substituting gears in another box, the relative speeds of the several spindles may be regulated. With the constant-speed drive shaft running at 550 r.p.m., spindle speeds ranging from 25 to 460 r.p.m. are available.

The threading spindle is driven through a separate train which allows the spindle speed to be adjusted with relation to the pitch of the thread to

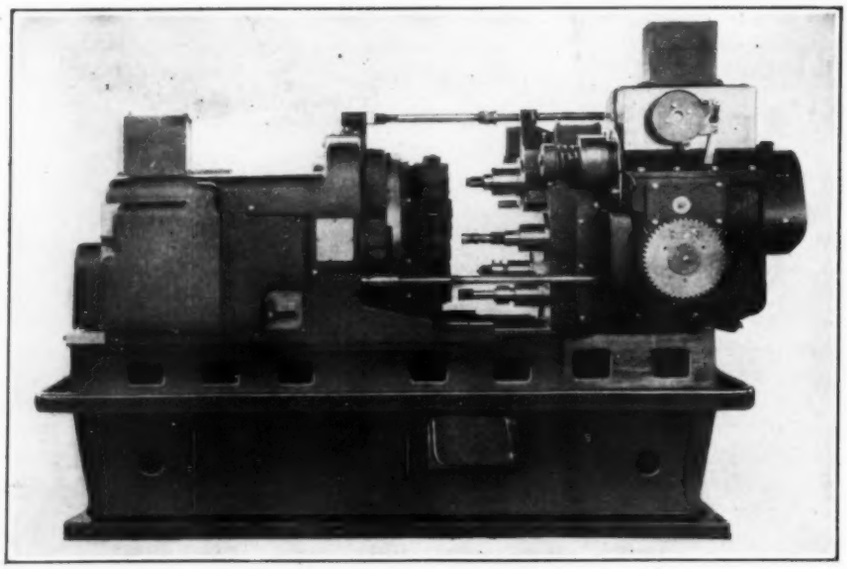


Fig. 3—A rear view of the machine

be cut. The advance and withdrawal of the threading spindle is independent of the movement of the turret slide, and is brought about by means of a master screw and nut of the same pitch as the thread to be cut upon the work. Master screws and nuts are provided for all commercial pitches, and are easily interchanged.

The machine can be equipped with a double-threading spindle to cut both external and internal threads concentrically, of the same or different pitches, at the same time. In this construction a sleeve surrounding the regular threading spindle is splined to it, but is free to advance and recede independently under the control of its own master screw and nut. A tap is carried by the regular spindle and a die-head by the sleeve.

Though the machine is automatic in its movements there is a safety feature provided to interrupt the cycle if for any reason the operator is delayed in loading the work. To insure continuous automatic action the operator must pull forward a small lever that is located convenient to the loading station. This movement he makes a part of his routine coincident with the removal of the wrench from the chuck. It can be done at any time during the cycle, but unless it is done the cycle will stop before the turret indexes.

The time required to produce a given part upon the machine is governed by the time necessary to complete the longest operation. It is often possible, however, to split a long operation by dividing it between the tools of successive spindles, in which case the time of producing the piece is materially lessened.

Power to drive the machine is transmitted through a silent chain to a sprocket at the rear, from the shaft of which all movements are derived by means of suitable clutches and gear trains. A constant-speed motor of 10 or 15 hp., according to the nature of the work and the severity of the operations, is recommended as the driving unit. The motor and chain are inclosed by removable guards.

The base of the machine is made in one piece, with a wide channel completely surrounding it to catch the splash. Below the working space, the top of the bed is inclined toward an opening in the rear through which chips may be removed without interfering with the service of the machine. Automatic lubrication is supplied to all rapidly-moving parts.

In the front view of the machine, Fig. 1, may be seen an electrically-driven power-operated chucking device, which is illustrated and described elsewhere in this issue. It is not regularly supplied with the machine but may be furnished on order.

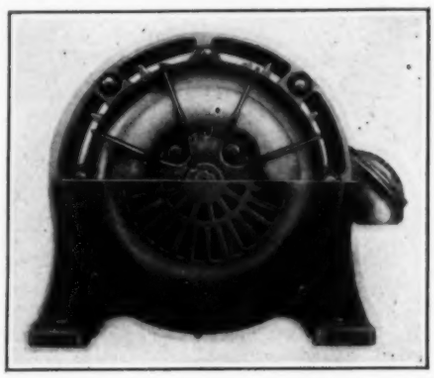
The gears to the right in Fig. 2 are the change gears to alter the spindle speeds without affecting their ratio, while those in the box determine the relative speeds of the several spindles. The group of gears to the left drive only the threading spindle. They do not affect, nor are they affected by, changes in any other gear train. The change gears by which the rates of feed of the turret slide are determined are in a box at the rear end of the slide. All gears are fully covered by guards when the machine is in action. Fig. 3 shows a rear view of the machine.

Wagner Air-Jacketed Motors

An air-jacketed motor for use where dust, fumes and moisture are present in sufficient quantities to necessitate protection to the motor has been developed by the Wagner Electric Corporation, St. Louis, Mo. The entire motor is surrounded by a jacket open at both ends and has fan blades mounted on a shaft extension between the sealed motor and the outer jacket. The only clearance between rotating and stationary parts of the motor is in the bearing housing, and it is so small that impurities cannot get past the grease packing.

This motor is of the standard type except for the external construction. The frame housing, the motor proper and all bearings are substantially air-tight. The end shield is made of cast iron, rib-reinforced and has a substantial grating which protects the fan and provides an opening for incoming ventilating air. The center shield is made of heavy sheet steel held in place by machine screws. The fan is of one piece construction. The conduit box is mountable in four positions.

The stator is the only part of the standard single-phase repulsion-induction and polyphase squirrel-cage motors that has been subject to change in design. The exposed outer rim is deeply grooved to increase radiation surface. The punching for windings remains unchanged while the stator



Wagner Air-Jacketed Motor

laminations are welded electrically.

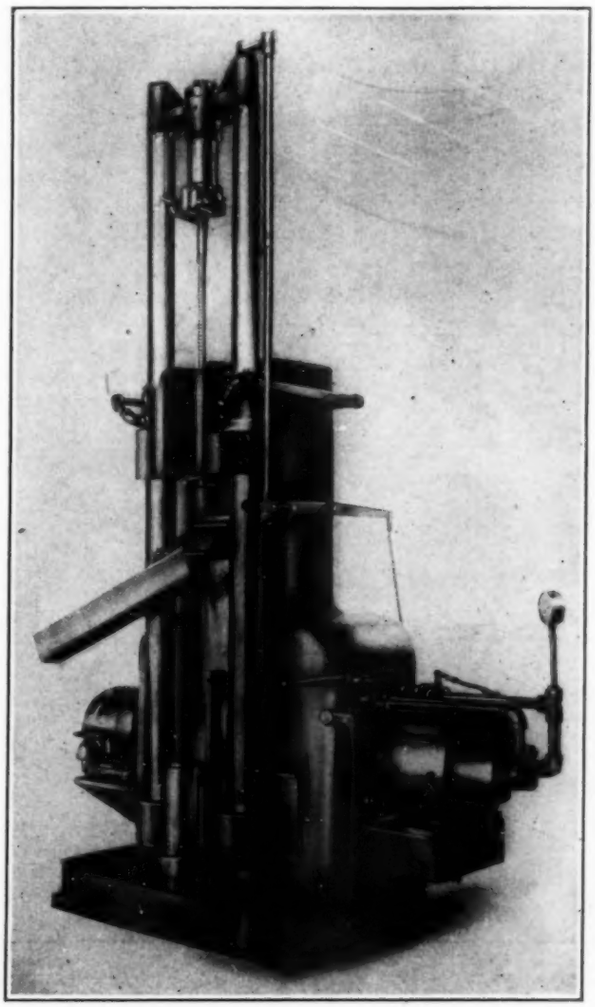
The motors are equipped with double-row ball bearings of the self-aligning type in one end plate and deep groove bearings at the other to take end thrust. The bearings are grease lubricated and are sealed in a dust-proof housing. The shafts are made slightly longer than those for standard motors to permit fan mounting. Single-phase repulsion-induction motors may be had in sizes from 1 to 20 hp. and polyphase squirrel-cage motors in sizes from 2 to 30 hp. These motors are designed for a temperature rise not to exceed 50 degrees.

"American" V-50 Vertical Broaching Machine

THIS vertical broaching machine, manufactured by the American Broach and Machine Company, Ann Arbor, Mich., occupies small floor space and permits broaching to be done under ideal conditions, it is claimed. Since the broach is hanging, it naturally centers itself, and the work, being suspended in the same manner, finds its own center. Furthermore, the machine is semi-automatic in operation, and all that is required of the operator is to place the work on the end of the broach.

The control of the machine is so arranged that the operator does not have to handle the broach whatsoever. When the broach is in the starting position, the work is slipped over the shank of the broach and the first treadle is pressed, causing the lower cylinder to advance the broach until it automatically connects with the pulling head. Then by applying a slight pressure on the second treadle the rams pull the broach upward. At the end of the stroke, the work drops on to the angle table, and slides out the chute into the tote pan. The pulling rams return to the starting position, releasing the broach automatically for the next operation. The machine is equipped with lubricating pumps. The machine is operated with oil pressure at 1,000 lb. per sq.in., in conjunction with two cylinders 4 in. in diam. The twin cylinders make it possible to operate the machine without the use of packing glands. A cutting speed of from 0 to 30 ft. per minute can be obtained, while the return speed varies from 0 to 80 ft. per minute. The space between the cylinders is 13 in., which allows the broaching of work up to that diameter. The capacity of the machine is 12 tons and the maximum length of broach that can be used is 50 in. The oil tank has a capacity of 50 gallons.

The machine is driven by a motor of 10 hp. running at 900 r.p.m. It requires floor space of 4x6 ft., and the operating height is 11½ ft. The total weight is 6,400 pounds.

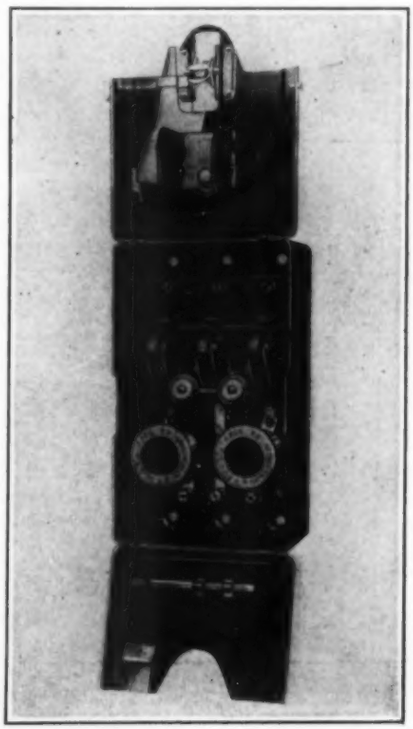


"American" V-50 Vertical Broaching Machine

Cutler-Hammer A.C. Manual Starter

Cadmium-plated overload cutouts giving complete motor protection, double-break roller contacts and a small dust-proof inclosing case are the outstanding features of the CH-9115 across-the-line a.c. motor starter, made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. The roller contacts by breaking the arc in two places prolong their usefulness by several times the usual life. In addition, the rollers turn after each operation and present a new contact surface for the next cycle.

Complete motor protection is ob-



Cutler-Hammer A.C. Manual Starter

tained during both the starting and running periods. The thermal-overload cutouts provide the necessary time interval for starting currents.

The dust-proof inclosing case has a cover made in two sections. This construction permits opening the lower section only for replacing fusible links in the thermal overload cutouts. The cover can be opened only when the starter is in the "off" position. Installation can be made without removing the panel from case, and all parts are easily accessible for quick inspection. These starters are suitable for use with small machine tools.

Brown & Sharpe Automatic Rod Magazine

AN EXTERNAL feeding mechanism, Fig. 1, known as the automatic rod magazine, has been developed by the Brown & Sharpe Manufacturing Company, Providence, R. I., for use with its No. 00 automatic screw machine, both regular and high speed types. This mechanism consists of an arrangement for holding several rods at the left end of the machine, and replaces the stock stands generally used.

When the machine is in operation, the next rod is automatically fed into the working-position as the preceding rod is exhausted. By its use, the non-productive time of a machine while it remains idle awaiting replenishment of stock, is greatly reduced. It also leaves the operator free to devote his entire time to the operation of the machine and requirements of the work as well as allowing each operator to care for a greater number of machines.

The automatic rod magazine is simple in design and construction and is operated by the automatic screw machine. The mechanism is connected with the feeding arrangement of the machine in such a manner that when the end of the bar on which the machine is working passes a certain point, a ratchet is engaged which feeds a stop forward. This stop comes in contact with the starting lever of the machine at the instant the last piece is cut off, stopping the machine simultaneously with the engagement of a clutch that delivers power to the rod magazine.

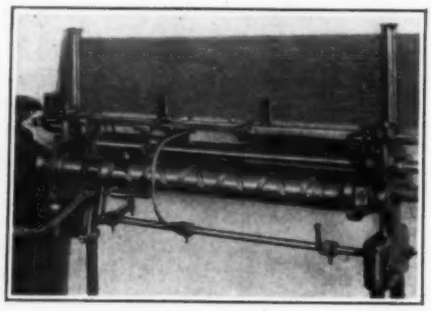


Fig. 2—Rods are dropped into the feeding position by the cylindrical cam which trips the magazine

When the clutch of the rod magazine is engaged, a long barrel cam, Fig. 2, on the rear of the device is set in rotation. The first movement of this cam trips the mechanism of the magazine and drops a rod into the feeding position. Its continued rotation advances a pusher at the end of the mechanism that comes in contact with the rod and feeds it forward through the feeding finger and chuck to the desired position. As the follower on the cam comes to the end of its travel, the starting lever of the machine is thrown into engagement and the machine is set in operation. The follower then returns to the starting position and the clutch of the rod magazine is thrown out of engagement. The operation of this mechanism is correctly timed with relation to the automatic functioning of the machine. The magazine proper can be filled at any time; accordingly the machine need not be stopped.

Sterling "Cros-Line" Totally-Inclosed Motors

Total inclosure is the main feature of the "Cros-Line" motors manufactured by the Sterling Electric Motors, Inc., Los Angeles, Cal. These machines are designed for across-the-line starting by means of push-button

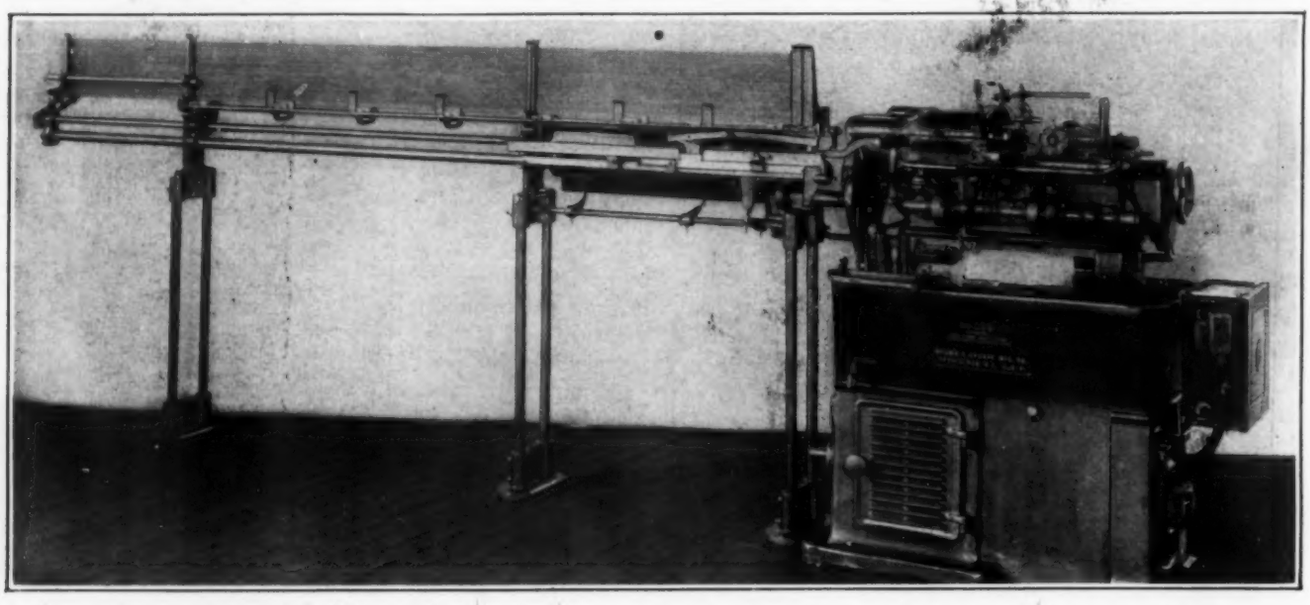
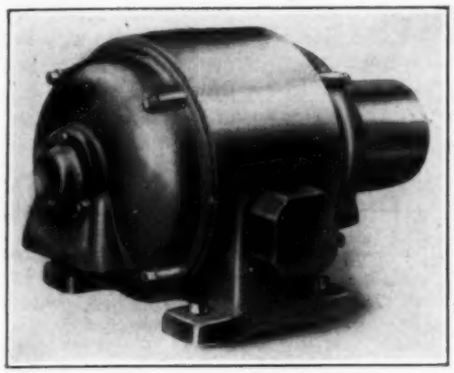


Fig. 1—Automatic Rod Magazine feeding rods to a Brown & Sharpe No. 00 Automatic Screw Machine



Sterling "Cros-Line" Totally-Inclosed Motor

control on either 220- or 440-volt circuits, as may be desired. They are mounted on either ball or tapered roller bearings in sizes from ¼ to 30 hp. for three-phase applications. Single-phase machines are built in sizes from 1 to 5 hp. for operation at various speeds. These machines may be mounted in any position.

Gross & DeLeeuw Screw Chuck-Operating Device

To relieve the operator of the fatiguing job of tightening and releasing the chucks of its improved chucking machines described elsewhere in this issue, the Goss & DeLeeuw Machine Company of New Britain, Conn., has developed the power-operated device illustrated in Fig. 1, which is also applicable to the older machines made by the same company, and can be adapted to other machines on which screw chucks are employed.

The device is entirely self-contained. It is mounted on the machine by a special bracket in such a position that the spade-handled socket wrench, Fig. 1, is in line with the screw of the chuck that is at the moment in loading position. To use it, the operator advances the wrench spindle to engage the squared end of the chuck screw, and depresses one of the pedals to be seen in Fig. 2 to apply the power.

The device consists of a special electric motor, a worm and wormwheel reduction gear, and the pedal unit. The motor is so designed and constructed that it may be stalled under full load without injury, and will sustain its full-load current while stopped for a reasonable length of time without undue heating. On the end of the rotor shaft is a hardened steel worm meshing with a bronze wormwheel, both fully inclosed and running in oil.

The wrench spindle passes through the bore of the wormwheel, which is supported on independent bearings, and is driven from the wormwheel by a lug that permits the wrench spindle to be turned through three-quarters of a revolution in either direction before encountering positive resistance. Thus the operator may push the wrench forward to the chuck screw and turn it one way or the other by means of the spade handle until the socket engages the squared end of the screw. Then by depressing the proper pedal, the power is applied to turn the screw until the motor stalls because either the chuck jaws close upon the work or they have fully opened.

Fig. 2—Pedal unit controlling the motor of the Chuck-Operating Device

The end of the lever, Fig. 1, rests upon and is supported by the wrench spindle as shown while the wrench is in engagement with the chuck screw. With the lever in this position the mechanism cannot be started. In order to start the cycle, the wrench spindle must be fully withdrawn and the lever allowed to drop by gravity. This lever is moved by the cycle mechanism, and under ordinary conditions need not be touched by the operator. It is impossible for him to either move the wrench spindle forward while the chuck-carrying member is in motion or start the cycle with the wrench engaged. The sole purpose of this lever is to prevent damage to the machine by keeping the wrench away from the chuck screws until it may be engaged properly.

The pedal unit is connected to the machine only through the wires necessary to conduct the energizing current to the motor.

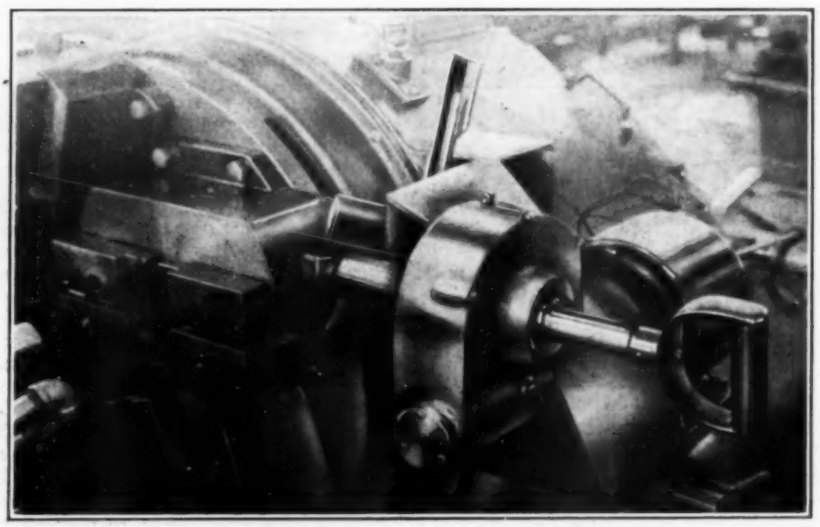
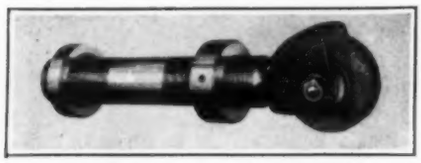


Fig. 1—Screw Chuck-Operating Device applied to a Goss & DeLeeuw Automatic Screw Machine

Ross "Master" Truing Tool for Cincinnati Centerless Grinders

A device known as the Ross "Master" truing tool for use with Cincinnati centerless grinders is being marketed by the Ross Manufacturing Company, Cleveland, Ohio. The unit employs an abrasive wheel, 5 in. in



Ross "Master" Truing Tool for Cincinnati Centerless Grinders

diameter, which turns on a grit-sealed ball-bearing spindle assembly. The shank of the tool fits into the slide of the grinder and is keyed to the truing slide holding the truing wheel at a 10-deg. shearing angle. The tool is fed against the grinding wheel by means of two threaded collars on the shank which are adjusted with spanner wrenches.

The tool is applicable to the Nos. 2, 3 and 4 Cincinnati centerless grinders by substituting a new guard supplied by the grinder manufacturer, with clearance for a 5-in. wheel.

Schuler Inclinable Power Presses

AIR CUSHIONING of the dies used in the Schuler inclinable power presses marketed in this country by J. I. Bernitz, 25 Beaver St., New York, N. Y., is made possible without the use of the usual accessory apparatus such as compressor, air receivers and piping by an arrangement that automatically restores the air pressure on the return stroke. Fig. 1 illustrates the use of the device as standard equipment on one of the eleven sizes of this machine while Fig. 2 shows a cross-section of the pneumatic die cushion.

These inclinable power presses are chiefly used with combination dies for simultaneously cutting, stamping, drawing and embossing the tops and bottoms of tins or boxes but will also handle heavier-gage material. The finished piece is ejected upwards, and slides out of the back of the press by gravity.

Several other interesting features

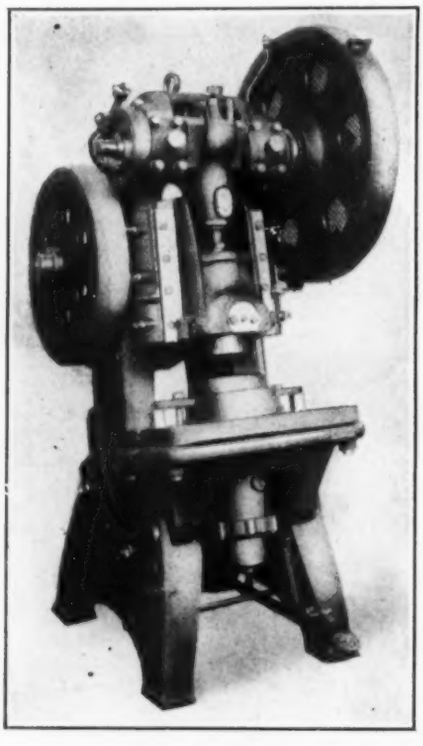


Fig. 1—Schuler Inclinable Power Press with Pneumatic Die Cushion shown as standard equipment

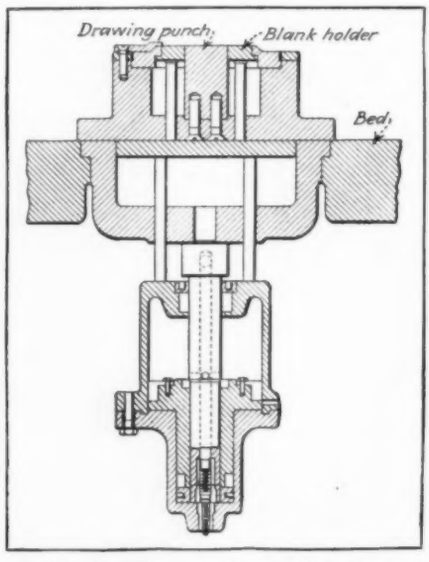


Fig. 2—Cross-section of Schuler Pneumatic Die Cushion

should be cited, one of which is the frame that can be quickly set to the inclined and vertical positions by means of a handwheel at the back. Another feature is that of the adjustable slide which runs in extra long gibs and is fitted with cap and screw for clamping the top dies. The adjustment provided for the smallest size is $1\frac{3}{8}$ in., while $3\frac{1}{4}$ in. is allowed for the largest size. Dies of varying heights may thus be accommodated. A detachable and adjustable bed which works in V-gibs permits further variation in the height of dies and is useful in connection with deep punching and difficult drawing or riveting.

The machine is driven from a two-speed motor mounted in the frame at the rear. Either 45 or 90 strokes per minute with an adjustment range of 0.4 to 3 in. may be obtained.

Pamphlets Received

BUSINESS STATISTICS. The Department of Commerce, Bureau of Census, has issued its "Record Book of Business Statistics—Part II," which is a background of facts from earlier years in comparison with data published monthly in the "Survey of Current Business." The section deals with metals and machinery. No attempt has been made to include data from earlier than 1909.

FOREIGN COMMERCE HANDBOOK 1928-1929. The Chamber of Commerce of the United States, Foreign Commerce Department, has prepared a booklet under the above title. The department aims to furnish members with a list of leading sources of import information in the country. Certain general resources are described briefly, after which, under alphabetically arranged headings, references are given to government agencies, associations, and publications. A list of foreign trade policy matters that have occupied the attention of the Chamber is appended. The booklet contains 44 9x6-in. pages. It is published every two years.

METHODS OF WAGE PAYMENT. The National Metal Trades Association, Chicago, Ill., has published a study by its Committee on Industrial Relations entitled "Methods of Wage Payment" which was undertaken to permit members of the association to arrive at a better understanding of the various incentive plans and methods of wage payment in use in the member shops. First an analysis of facts pertaining to the use of incentive plans and wage payment is presented, and second, detailed descriptions of the various plans in use together with comparative charts are given.

VOCATIONAL SCHOOL SAFETY WORK. The National Bureau of Casualty and Surety Underwriters, One Park Ave., New York, has published a manual entitled "Safety Education in the Vocational School; the Construction of a Curriculum for Accident Prevention." This curriculum has been prepared to assist in the teaching of safety in the vocational schools, in order that the pupils will gain a proper appreciation of the subject for use in later life. The curriculum, which has been scientifically prepared for apprenticeship instruction, deserves the careful consideration of educators, safety engineers and industrialists.

NEWS OF THE WEEK

Rapid Advance in Aeronautics Evident at Detroit Show

THAT aviation is rapidly developing into a permanent industry was clearly shown by the exhibits at the All-American Aircraft Show held in Detroit, April 14 to 21. The large convention hall was completely filled with planes, engines, instruments and accessories. The show was the main event of Aviation Week, proclaimed by the mayor, and was aided by meetings and addresses at many clubs.

All the planes shown were flown to Detroit, some from the West Coast. Forty-one plane builders were represented, in addition to forty-five manufacturers of engines, instruments and accessories. The value of the planes was set at a half million dollars, varying from a small single-seater plane to the huge Byrd Antarctic Ford, valued at approximately fifty thousand dollars. The commercial planes shown (no strictly military planes were exhibited), included those to carry ten people. The majority, however, carry from three to five persons, as with the automobile. Engines vary from three cylinder, 30 hp. for carrying a single person to single engines of 400 hp. and multiple-engined planes up to 700 horsepower.

Contrasting the planes shown with the contraptions of wood, bamboo, wire and cloth that constituted the early airplanes is very illuminating and shows progress that can only be equalled by a similar comparison with the automobile. There is, in fact, a marked resemblance in the growth of the two industries and it seems strange that more automobile builders have not ventured into the aircraft field. In both color and body design the modern plane has followed the automobile in many ways. Striking color combinations were much in evidence and the closed cabin plane now predominates as in the automobile. De luxe cabin fittings, by the best known coach builders, give Pullman accommodations for long distance air travel.

One of the most interesting features of the show was the evidence of attention being given to the engine, the vital element of all planes. This has become a necessity in the extended use of planes and it is of interest to note that two well-known machine tool builders are now building aircraft engines. The Pratt & Whitney "Wasp" and "Hornet" have already proved themselves and the R. K. LeBlond Machine Tool Co. has begun building the "Aircat" radial engine in several sizes. Other new engines are also in the field, some of foreign design.

That aviation is becoming more popular was clearly shown by the crowds and the intelligent interest that has supplanted idle curiosity. The airmindedness of the younger portion of the present generation prompted close inspection of plane and engine details and of instruments, all with the possibility of owning a plane. The demonstrating model of the Pioneer earth-inductor compass, made famous by Colonel Lindbergh and others, was a center of attraction. Instrument boards were in evidence in all planes, those intended for regular flying being particularly well equipped. Here again is a trend similar to that of the automobile.

Another noticeable feature was the increase in planes with pontoons or boat bodies. Two amphibians, two small flying boats and a number of planes with pontoons for water landing showed a marked advance in that line of development. The use of metal is also increasing.

It is difficult to realize that there are now more concerns building aircraft than automobiles. The number is likely to increase and then diminish as in the automobile industry. However, Michigan is making a bid for aircraft industry and the centering of automobile builders in Detroit would seem to give it an advantage, but judging from the number of planes now being built, Kansas, Ohio, Illinois, Colorado and other states both east and west, there is not likely to be the same centralization as in automobiles.

Fact-Finding and Employee Representation Discussed by Political Scientists

Astonishing increases, not only in total output but also in the amount of production per man, and the attitude of labor toward these changes, were the reasons behind the calling of the conference of the Academy of Political Science at the Hotel Astor on April 12, to consider the need and status of "Fact-Finding in Labor Disputes."

Edward T. Devine, dean of the Graduate School, American University and a member of the U. S. Coal Commission in 1922-23, told of the work of this commission. He felt that collective bargaining, based on the facts of the industry, was the only hope of the miners.

The Supreme Court's control over the use of injunctions in labor disputes was outlined in considerable detail by Prof. Thomas Reed Powell, of the Harvard Law School. He pointed out glaring inconsistencies in the gravity of injunctions, how they frequently override state laws, and how some of these injunctions have been reversed after 5 to 10 years. T. Y. Williams, representing an employer's organization, contended that injunctions were only for the purpose of preventing unlawful acts and consequently should be upheld and not criticised. In reply Morris Hillquit pointed out that many labor injunctions prohibited lawful acts that were guaranteed by the constitution.

Prof. Richard H. Lansburgh, of the University of Pennsylvania, advocated that labor fact-finding be made a government function. Government agencies should not serve solely as a police power, but should aid in avoiding conflict by presenting the facts of an industry to those interested. Prof. John H. Richardson, of Cambridge University, told of the way in which fact-finding boards had helped British industry.

The second session dealt with trade-union and employee representation, the first paper being by Dr. William M. Leiserson, professor of economics at Antioch College, who gave a warning to both employers and unions regarding employee representation. Harvey G. Ellerd, personnel department of Armour & Co., outlined the experience of his company with their own union. Otto S. Beyer, Jr., consulting engineer for the Baltimore & Ohio shop-craft organizations, outlined the establishment and successful working of this method of co-operation in shop efficiency and operation as well as grievances.

The trade-union attitude toward fact-finding bodies was well presented by K. C. Adams, director of research, United Mine Workers of America, who declared that the economic ends of capital and labor were the same. Fact-finding is needed to show that hand-operated mines cannot compete with mines having modern equipment, merely by reducing wages. Mine unions want coal put on the public utility basis the same as railroads.

Prof. Herman Oliphant, of Columbia, and Henry S. Dennison, of the Dennison Manufacturing Co., discussed the two types of unions. Both agreed that no company union should prohibit its members going to any other organization.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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A STRANGE epidemic has gripped the children and young people of St. Paul, Minnesota. According to a dispatch published in the New York *Times* last week they are all striving for endurance records in skipping rope, bouncing balls, flying kites or keeping awake. One girl bounced a ball 2,710 times, another skipped a rope for 535 turns; a boy named Alvin Bunde succeeded in staying awake 72 hours, and a crew of kite flying lads won a prize by keeping their craft aloft for two days and nights.

This may seem an odd preface to a review of business conditions, but it is more germane than may at first appear for the St. Paul epidemic is not without its resemblance to the mania that is finding expression on the Stock Exchanges of this country and Europe. Both involve striving for records; both are psychological manisfestations and both attest the susceptibility of the crowd to influences which excite its imagination even though they lead to danger.

From the days of the Crusades to those of the Florida boom such episodes have been recurrent. Sometimes they reflect religious excitement, but their inspiration has generally been the hope of gain which, sad to relate, has been as generally disappointed. Our knowledge of psychology, and crowd psychology in particular, is so superficial that an intelligent appraisal of these crowd movements or their probable duration is impossible. All we know is that they usually have their origin in a fortuitous combination of circumstances, and that once started they continue until some dramatic incident occurs to convince people that it is perilous to assume that the trees will grow to the skies or that prices will always advance.

In the interval between the beginning and the end of such booms the enthusiasm that they engender often spreads from one market to another, with the result that the entire business complex becomes involved and intrinsic values are lost to sight. That is what now seems to be happening. The upward movement in stocks which has lasted for nearly four years has already extended to Europe and there are some indications that the commodity markets are becoming slightly infected. This is suggested by the readiness with which cotton and grain respond to bullish news and their insensibility to anything that would normally cause a decline in prices.

As to the stock market itself it is plain that it has the bit in its teeth, for it was almost unaffected by 6 per cent money or the continued expansion of brokers' loans. A new school of financial philosophy is in fact developing. Its adherents maintain that enlarged borrowing is an evidence of increased wealth and that big loans mean big profits for the banks and bigger dividends for their shareholders. Hence bank stocks now are becoming the favorites of speculation and the shares of one prominent institution have risen to a price which represents a valuation of half a billion dollars for its good will. Investment trusts are said to be buying the stock at this price and their shares are in turn being bought by other investment trusts to the great concern of conservative financiers who realize that confidence may be seriously disturbed when the tide turns and bank stocks begin to decline.

Of course no one can tell when the end will come, but it must be admitted that it is not yet in sight. Securities continue to advance, and rubber, coffee and sugar are the only speculative commodities that are lower than they were a week ago. The drastic decline in rubber which has carried it below 20 cents is due to the situation that has been created by Great Britain's abandonment of export restriction, and coffee and sugar reflect the fear that Brazil and Cuba will decide to follow England's example in surrendering her control of rubber production. This may be true of coffee, but close students of conditions in Cuba think that nature may reduce next year's sugar crop and thereby advance the price.

Less is heard of unemployment, and the statisticians of the building trade claim that the new construction planned or commenced is in excess of last year.

The monthly report of the Steel Corporation shows a slight decline in unfilled tonnage, and the news from the industry in general is perhaps a little less optimistic than it was.

Wheat has had a sensational advance on a very unfavorable report from the Department of Agriculture, and corn improved, in sympathy. Cotton is higher upon what is said to be Wall Street buying, and it seems ready to advance further, although the domestic consumption for March is below expectations and the New Bedford mills have reduced wages by 10 per cent.

The news from abroad is in the main satisfactory and a further improvement in British trade appears to be indicated. But Europe's dependence upon American capital is evident in the many foreign loans floated here from day to day, and our ability to make these loans is in turn dependent upon the money market. Rates for both long and short time funds are already higher, and if they should continue to advance a decline in the stock market or a lessening in the world's commercial activity would certainly follow. Of the two the former is greatly to be preferred.

WHAT'S DOING IN INDUSTRY

GENERAL satisfaction about conditions in the machine tool market is evident in the past week. This conclusion is checked by figures of the National Machine Tool Builders' Association that indicated March the best month in some years. In Cincinnati sales are at a good level and several companies are elated at the volume. One reason for this condition is the fact that purchases from automotive shops have picked up considerably, after a disappointing start. In Detroit there is a great period of prosperity due to the fact that most automobile factories are working at top speed. A fair demand from such shops in the Indianapolis district is also noted.

SALES of machinery and machine tools in the Southern district have been somewhat under the volume for the same period last year, but the general outlook is satisfactory. Sales in New York, which is a dealers' market, on the other hand, have been well above last year's figures. In fact, the last quarter has been the best in some years. In Chicago there has been a slight falling off in trade, but March business exceeded that of February by a good margin, and a good year is expected. New England builders are fairly busy, most shipments going to outside points.

LINES that are active are woodworking machinery and road-building equipment. Railroad buying is beginning to pick up, particularly in Canada. This buying includes rails, cars and shop equipment.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

DETROIT

Detroit is passing through a period of prosperity that equals, or perhaps exceeds the conditions of 1926 when the automobile business was unusually profitable. As far as the machinery and machine tool business is concerned in the Detroit district, there is little left to be desired. Not only are orders coming in steadily for all types of machinery but there is a regular and increasingly encouraging flow of inquiries. In almost all lines, deliveries are far behind orders and there seems little likelihood that they will catch up soon.

Without exception the automobile plants and all of the plants in associated industries, are running at top speed. The Ford Motor Co. increased its production to 2,000 cars a day and is steadily increasing the output. A great deal of work is being farmed out to small shops. All of the body plants are working to capacity. Employment is still rising steadily and conditions augur well for the immediate future.

The new assembly plant of the Oakland Motor Car Co. at Pontiac, built at a cost of $3,000,000 was officially opened April 17. The Willys-Overland plant at Toledo is working at top speed and is turning out more cars than at any time in its history. The paper mills at Monroe are making extensive increases to plant and equipment, as is the Auto Equipment Co. at Monroe.

CHICAGO

A slight falling off of business in certain branches of the machine tool industry is reported as having taken place in the last few days. In the main, however, the volume of trade has been well maintained, and such decline as has been noted is regarded as not likely to continue. Additional reports for March are to the effect that during that month sales reached a point greatly beyond expectations, the total for the month exceeding the average shown in January and February by anywhere from 15 to 40 per cent. It may be said, therefore, that the machine tool industry at the present time is on a sound and satisfactory basis, with no indications that there will be any change in conditions for the next three or four months.

Men at the head of the industry, looking toward the future, express the belief that the volume of business during the fall and early winter will round out a prosperous year for those engaged in it. Optimism seems to be in the air.

No new railroad buying is reported, but it is intimated that the Rock Island will shortly enter the market with a view to purchasing shop equipment to include a number of tools. Business in used tools, while not markedly active, is reported to be fairly satisfactory.

CINCINNATI

Nearly all machine tool manufacturers in the Cincinnati district report that their sales were at a good level the past week. Some go as far as to express elation at the volume and nature of the business booked in the period and there seem to be none who are not at least mildly pleased by the amount of business done. Selling agents also report that there was enough improvement in market conditions in local territory to give encouragement.

While no large orders from the automotive field were received in the week, the aggregate business from this source was considerably larger than in the previous week. The feature of the week's business was the sale of a well-diversified line of single tools and replacements, the purchasers of which were general machinists and miscellaneous users, located in all sections of the country. A few scattering orders came from railroads, these also being for single tools.

The great majority of the manufacturers, and also most of the selling agents, report that the number and nature of the inquiries received in the past week were most encouraging. They partook of the same character as the orders.

Several manufacturers have increased their working forces and it is thought that others will do likewise in the very near future.

INDIANAPOLIS

Little change is seen in the machinery or machine tool business here, though prospects seem a little better than two months ago. There appears to be a well defined tendency on the part of buyers to proceed carefully until it is determined just about what effect the primaries and election will have on business this year. There is a fair demand from the railroads, but the volume is not ahead of last year and indications now are that no extensive repair programs will be inaugurated before fall.

The last two weeks have witnessed a rather brisk increase in sales of road construction machinery. In fact all contractors' equipment is selling better than for some time. Some dealers say the demand is better now than it was this time last year and that inquiries lead them to believe the general season will be better.

A fair demand comes now from the automobile factories. The demand for smaller tools is somewhat better than for heavy machinery, and the indications point to an entirely satisfactory spring season. Also, with the body plants there is a demand for special machinery, particularly woodworking machinery. These factories have had an exceptional business now for some time and are making several replacements and some new installations.

Demand from the steel trade both here and in the north part of the state, is only fair. There are indications of improvement, however. A good demand is now on for small garage equipment. Hundreds of garages are preparing for more repair work this spring and call for grinders, small lathes and similar tools is very good.

CANADA

Outlook for the metal-working industry in Canada during the next five or six months is exceptionally bright. The railroads are now planning large expenditures. Builders of rolling stock and the rail mills are already working on the forerunners of these orders. The Canadian National Railways' 1928 program, as recently announced, calls for an expenditure of $25,000,000, the bulk of which will go towards the general betterment of the physical property of the railroad.

Iron and steel production has taken a sharp upward turn. Output of pig iron during the first two months of the year was 129,697 tons, an increase of 26 per cent over the corresponding period last year. Production of steel in the two months was 183,115 tons, an increase of 61 per cent over the same two months in 1927.

The continued upward trend in new construction is an important factor in the situation. Construction contracts awarded in March throughout the Dominion were $22,946,000. This total exceeds that of March, 1927, by 21 per cent, and is the largest total for that month since 1914. For the first quarter of the year the aggregate is approximately $70,000,000, an increase of 28 per cent over the corresponding three months of 1927, exceeding all previous records.

While the outlook for the automobile industry is promising, production so far this year has been below last year's record. For the two months ending February, the output of cars in Canada amounted to 20,967 or about 38 per cent less than the 34,031 cars produced during the corresponding period of 1927. Production suffered at Oshawa recently when about 3,000 employees of General Motors of Canada went on strike, but the men are now back at work.

NEW ENGLAND

A greater part of the business placed with machine tool builders of this section has come from sources located outside of New England. The week presented little change in the general aspect of business, but builders and dealers, alike, seem satisfied with existing conditions. Orders placed continue to be for single tools, which collectively amounts to a very sizable and substantial volume.

Distributors of used machinery report a fair volume of business. Small lathes, drills, automatics and grinding equipment constituted the bulk of the demand of the current week. One dealer in particular has been hard pressed to fill his demand for grinding machinery.

During the week the Bassick Division of the Stewart-Warner Co. closed the long-standing deal for the purchase of a six-story Bridgeport plant, formerly occupied by the Columbia Phonograph Co. Newark and Meriden divisions will be moved to Bridgeport, and machinery is to be transferred at once.

In last week's letter a large manufacturer of heavy automatic production machinery was misquoted to the effect that retooling of existing equipment is seriously affecting the sale of new tools, citing as an example the retooling of 450 heavy production automatics. The situation referred to is correctly stated to be as follows: A buyer making a popular small car in the Middle West retooled over 300 heavy production automatics, the remainder of approximately 450 machines in the plant being held for parts manufacture of a previous model. In addition more than 100 new machines were purchased for the new model.

SOUTHERN DISTRICT

Though machinery and machine tool business in the southern district was larger during the first quarter of this year than distributors had predicted it would be the early part of January, it was somewhat less than the normal level for that period, and also less than the volume of business during the first quarter of last year.

Woodworking machinery, however, enjoyed a considerably larger volume than last year. Sales during the first quarter were the

largest in some years, and sales in the last quarter of 1927 also were substantially larger than normal. Furniture factories in the Georgia, Carolina and East Tennessee territory have been the most active buyers, but sales also have been large to other branches of the woodworking business all over the southern district.

Equally as good demand was reported for road-building machinery as last year and a better demand than last year for contractors' machinery and equipment, these lines being active in all Southern states. Railroads have been fairly active in the market for heavier equipment for machine shop use, sales being about on a par with last season.

Demand for garage equipment was not very active during the first quarter, with a majority of sales reported being of used or rebuilt equipment, while the same also was true of smaller machine shops.

Outlook for the second quarter is generally satisfactory, and business is expected to average about normal except woodworking machinery, which promises to continue better than normal the next few months.

NEW YORK

Dealers in machine tools in the metropolitan district continue to maintain the high level of business reported last week. While no outstanding orders have been placed since that time, a steady volume of orders has been responsible for the present optimistic situation.

Inquiries are particularly active. The General Electric Co., always a buyer, has sent out about twenty lists, some of which contained a sizeable quantity of tools. The New York Central R.R. has also issued a large number of new lists and has reopened old ones. Worthington Pump is in the market for a large horizontal boring mill with a 20-ft. table, and Bethlehem Steel has asked for quotations on equipment for its Sparrows Point plant. The list includes some lathes, bending rolls, slitters, a planer, and a horizontal borer, all of large size. Dwight P. Robinson & Co. are contemplating purchases for export. Inquiries for engine lathes included two lists of four machines and one of six.

Among the equipment sold in the past week for consignment to outside points were: a 15-ton crane to E. I. du Pont de Nemours Co., an axle lathe and a 1,500-lb. steam hammer to a mining company, a No. 10 Stanley drill to the Boston & Maine R.R., a 36-in. drill to C.R.I. & P. R.R., a centerless grinder to the Ingersoll-Rand Co., a number of engine lathes, a 12-in. vertical shaper, and some large second-hand machines. An order containing about twelve items was received from a school in Washington, D. C.

Program for Pittsburgh A. S. M. E. Meeting Presages Record

Announcement has just been made of the spring meeting program of the American Society of Mechanical Engineers which meets in Pittsburgh, Pa., on May 14, for a three-day session. Three major trips of outstanding interest have been arranged by the committee. Tuesday afternoon has been selected for a visit to the United States Steel Corporation's plant and special trains for the tour will be available. On Wednesday afternoon a visit will be made to the plant of the Westinghouse Electric & Manufacturing Co. and on Thursday there will be a trip to the American Window Glass Company.

The committee also has planned a series of entertainments and excursions, the principal feature of which will be the annual dinner on Wednesday evening, May 16, at which the Holley Medal will be presented to Elmer A. Sperry for his development of the gyroscope.

The conference will open Monday with a discussion on "Management," jointly with the Pittsburgh Section of the American Ceramic Society. "Systems of Workman Payment in Porcelain Factories," by H. N. Kraner, and "Education and Training for Industries," emphasizing the "Training of Minor Executives in a Rapidly Growing Organization," by A. J. Beatty, will be the principal addresses of Monday's session.

Wednesday will be devoted to the following subjects: Machine Shop Practice: "Some Common Delusions Concerning Depreciation," by Ernest F. DuBrul, and "Ball-Bearing Machine Tool Spindles," by Thomas Barish; Applied Mechanics: "The Theory of the Dynamic Vibration Absorber," by J. Ormondroyd and J. P. DenHartog, and "Theory of Strength of Steel Columns," by H. M. Westergaard and W. R. Osgood; Engineering Education: "Industrial Co-operation in Education," by A. T. Jewett and "Education and Training As Applied to the Engineer," by F. L. Bishop.

Thursday's session will be given over to alloys, dealing with the "Mechanical Properties of Aluminum Casting Alloys at Elevated Temperatures," by R. L. Templin, C. Braglio and K. Marsh; "Study of Tin-Base Bearing Metals, Part I," by O. W. Ellis and G. B. Karelitz; Applied Mechanics: "Torsional Stress Distributions in Prismatical Bars" by L. S. Jacobsen, and "Stresses in the Drive System of Three-Cylinder Locomotives," by F. Loewenberg.

Madison-Kipp Corp. Buys Force-Feed Lubricator Div. of Detroit Lubricator Co.

The Madison-Kipp Corporation, of Madison, Wis., has purchased from the Detroit Lubricator Co., of Detroit, Mich., its entire mechanical force-feed lubricator division, with the exception of the locomotive type of lubricator. Through this purchase the Madison-Kipp Corporation acquired all equipment, patents, designs and inventory used in the production of Detroit Models "G," "JT," and "JTS" force-feed lubricators. The Detroit Lubricator Co. will continue to manufacture its hydrostatic type of lubricators as well as its locomotive force-feed type.

All physical assets involved in the purchase will be shipped to Madison, Wis., and all activities in connection with this new line will be handled at the factory and offices in Madison. It is expected that all equipment, drawings and inventory will have been assembled for car-loading shipments by April 25. The Detroit concern also is a large manufacturer of carburetors, radiators, valves and accessories for heating plants, which lines are not in any way involved in the present arrangement, the transfer being an outright purchase and in no way affects the capital stock or management of the two companies.

Business Items

The Trico Fuse Manufacturing Co., of Milwaukee, Wis., maker of Trico fuses, announces the removal of its Pittsburgh offices to the new and larger quarters to 405 Penn Ave., that city. William A. Bittner and his staff are in charge.

The Trumbell-Vanderpoel Electric Manufacturing Co., of Bantam, Conn. manufacturer of safety switches, knife switches, panels and switchboards, has opened an office in Boston, Mass., with Frank W. Garner in charge.

The Kansas City Oxygen Gas Co., 2012 Grand Ave., Kansas City, Mo., manufacturer of compressed gases, is establishing a plant to serve the eastern section of the country and for the export trade at McComas and Race Sts., Baltimore, Md.

R. D. Woods & Co., of Philadelphia, Pa., engineers, iron founders and machinists, have announced the recent opening of a new southern office at Charlotte, N. C., for the development of the company's trade in the Carolina territory. Edwin L. Lame is in charge of the branch as district manager.

The industrial commission of the Indianapolis Chamber of Commerce has announced that the Glenn Locomotive Co., specializing in the reconstruction of locomotives, has moved from Cincinnati to Indianapolis and is occupying part of the buildings of the Interstate Car and Foundry Co.

The Black & Decker Manufacturing Co., of Towson, Md., recently has made several changes in its sales organization. The following now are selling that concern's line of portable electric tools: H. L. Blake, Kansas City branch; G. F. Parr, Buffalo; H. B. Austin, Chicago; and J. A. Murray, Baltimore.

The Doehler Die Casting Co., has removed its executive offices from Brooklyn, N. Y. to 386 Fourth Ave., Manhattan. In the announcement it is set forth that the transfer was brought about owing to overcrowded conditions in the Brooklyn plant, where every available foot of floor space is required for production.

The Henry G. Thompson & Son Co., of New Haven, Conn., manufacturer of "Milford," "Mil Flex" and "Mil-Hy" hack saw blades, has announced that the F. M. Slater Saw Co. has been appointed its Detroit representative. Metal cutting band saws hitherto manufactured by the Slater company now will be made by the Thompson concern.

The Dry Wood Bending Products Co., of Muncie, Ind., has sold its buildings and real estate to an automobile parts dealer for $30,000. The new owner expects to occupy the buildings by May 1. The Bending company, of which Clay Prosser is president, will discontinue the manufacture of wood products, but will make wood bending equipment for other companies.

Articles of incorporation have been filed with the Secretary of State in Indianapolis by the Eaglesfield-Link Co. of Brazil, Ind. The corporation has an initial capital stock of 4,000 shares of no par value stock and is formed "to manufacture and sell all kinds of machinery, machines and equipment." The incorporators are R. D. Eaglesfield, Dick Link and Thomas W. Hutchinson.

The Wayne Co., of Fort Wayne, Ind., manufacturer of precision industrial machinery and gasoline and oil-pumping equipment, announces the consolidation of its extensive interests in the Southeast by the establishment of a direct factory branch in Atlanta, at 254 Spring St., from which point the company's trade in that territory

will be handled. F. O. Sallee will have charge of the branch as district manager.

The R. D. Nuttall Co., of Pittsburgh, Pa., announces that its commercial activities, as of April 1, 1928, will be handled by and through the parent organization, the Westinghouse Electric & Manufacturing Co. J. E. Mullen, former assistant sales manager, will head the new commercial organization with offices at the Pittsburgh Nuttall plant. Inquiries should be addressed to the nearest Westinghouse district office.

The J. H. Williams & Co., of Buffalo, and the Husky Wrench Co., of Milwaukee, producers of high grade wrenches, have joined in a working arrangement whereby they can offer to the trade a complete line of combination wrench sets composed of the Williams "Super-Wrenches" and the "Husky" socket wrenches. This combination has been made for selling purposes only and does not affect the financial structure or management of either company.

The Indiana Truck Corporation, of Marion, Ind., which recently was merged with the Brockway Motor Corporation of New York, has announced that no radical changes are contemplated in the production or personnel of the Marion plant. The product will continue to be marketed under the name of Indiana Truck. John A. Rhue, treasurer of the Marion company and assistant treasurer of the New York corporation, has returned to Indiana from New York.

The American Brake Shoe & Foundry Co., of New York and the National Bearing Metals Corporation, of St. Louis, have asked stockholders to ratify a proposed combination of the two companies. The plan calls for a mutual purchase of interest in each company by the other, but with each organization retaining its identity. The Brake Shoe & Foundry Company manufactures brake shoes for railroad cars and iron castings. The National Bearing Metals Corporation manufactures a wide range of brass and bronze products.

Personals

WALTER R. CLARK has been appointed general manager of the Bridgeport Brass Co., of Bridgeport, Conn.

LEONARD WEIGHT, formerly assistant secretary of the Machine Tool Trades Association, of 70 Victoria St., London, S. W., England, has been promoted to secretary of that organization.

J. J. SACKS, service engineer, of the Fusion Welding Corporation of Chicago, left April 15 for Mexico City. He expects to spend several weeks there as the invitation of the Steel Works, "La Consolidada."

GEORGE L. MEYERS, JR., for several years purchasing agent for the Stewart-Warner Speedometer Corporation of Chicago, has been placed in charge of production and will continue his supervision over the company's purchases.

WILLIAM MCCORMICK has resigned as Pittsburgh sales manager of the Niles Tool Works Co. and the Pratt & Whitney Co. and now is Western sales representative of Leeds, Tozzer & Co., Inc., 75 West St., New York City.

H. B. HAZERODT has resigned as manager of the Detroit branch of the Black & Decker Manufacturing Co., of Towson, Md., and J. H. Walker, who has been a salesman in that territory for several years has been appointed to succeed him.

J. W. INNES, formerly with the Durant Motors, Ltd., and the Gray Dort Motors, and more recently superintendent of the Kelvinator Co., of Canada, Ltd., has joined the Toronto staff of the Arthur Jackson Machine Tool Co., as sales representative. He will cover the Hamilton and Niagara Peninsula districts in Ontario.

CHARLES H. NORTON, of the Norton Co., Worcester, Mass., will speak on "The Engineer's Place in Industry" before the New Britain branch of the American Society of Mechanical Engineers on April 25. His subject, it is understood, will have special reference to the relation of labor-saving machinery to unemployment.

C. E. MCCAMPBELL, for the last 14 years foundry superintendent of the Gisholt Machine Co., of Madison, Wis., has resigned. Mr. Campbell received his education at Wabash College, Crawfordsville, Ind., and served an apprenticeship at the Rockwood Manufacturing Co., of Indianapolis. He later became foundry superintendent of the Chain Belt Co., of Milwaukee.

E. J. P. FISHER, research metallurgist for the Diamond Chain & Manufacturing Co. of Indianapolis, spoke on "Principles and Theories of the Hardening of Steel" at the last meeting of the Indianapolis chapter of the American Society for Steel Treating. The officials of the Indianapolis chapter announced that the Indianapolis chapter would co-operate with the Notre Dame and Fort Wayne Chapters in the second annual heat-treating conference at Purdue University to be held May 10 and 11, next.

ROBERT WEATHERLY, assistant sales manager of the Federal Abrasives Co., of Birmingham, Ala., has been appointed sales manager of that company and other subsidiaries of the Federal Electrochemical Co., (better known as the Federal Phosphorus Co.), the Federal Carbide Co., and the Southern Manganese Corporation. His headquarters will be at the Birmingham offices of these companies. S. D. Crenshaw, Jr., and H. P. Walmsley, have been appointed assistant sales managers of the Federal Abrasives Co., and will maintain headquarters at Birmingham and Philadelphia, respectively.

J. B. GREEN, president of the Fusion Welding Corporation, of Chicago, after making a 5,000-mile lecture tour of this country, left for a vacation in Mexico City. Learning of his lectures on technical subjects before university conferences and national engineering societies, friends in the Mexican capital succeeded in pressing Mr. Green into service as a lecturer. A recent communication tells of his addressing a distinguished audience of engineering on "Welding." He reports a keen interest by Mexicans in American methods of metallic arc welding and sees a strong demand there for Americans with a working knowledge of welding engineering.

Obituaries

MATT BRODIE, manager of the Asiatic territory covered by the Sullivan Machinery Co., of Chicago, died recently. He entered the employ of the Sullivan company following his graduation from the Massachusetts Institute of Technology. He had been manager of the firm's Asiatic business for the past ten years with headquarters in Tokyo, Japan.

WILLIAM STUART AUCHINCLOSS, 87, author and inventor, died recently at his home in Atlantic Highlands, N. J. Mr. Auchincloss, born in New York, was graduated from Rensselaer Polytechnic Institute in 1862. He invented an averaging machine for rapid calculation, was United States Commissioner at the Paris Exposition of 1867, and was the author of several books, including "Link and Valve Motions."

WILLIAM F. BOCKHOFF, president of the National Automatic Tool Co., of Richmond, Ind., died recently in his 66th year. For a period of twenty years he was a salesman with the National Cash Register Co., of Dayton, Ohio, and while there invented a multiple cash register drawer which he sold to the company. In 1909 he purchased the National Automatic Tool Co., at Dayton and moved the business to Richmond.

A. L. BROOMALL, aged 44 years, manager of the renewal parts engineering department of the Westinghouse Electric & Manufacturing Co., died April 10 from pneumonia. Mr. Broomall graduated from Lehigh University in 1906 with the degree of B.S. in electrical engineering and immediately entered the employ of the Westinghouse company. His first important work was on the installation of the first electric locomotives on the N. Y., N. H. & Hartford R.R. From 1911 to 1915 he had charge of the design of electric vehicle motors, after which he headed the d.c. motor section, later being transferred to the renewal parts engineering department.

Forthcoming Meetings

American Gear Manufacturers' Association. Twelfth annual meeting, Rochester, N. Y., April 19, 20 and 21, Hotel Seneca. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

American Welding Society. Annual meeting, week of April 23, New York City. M. M. Kelly, secretary, 33 West 39th Street, New York City.

National Metal Trades Association. Thirtieth annual meeting, Hotel Astor, New York, April 25 and 26. J. E. Nyham, secretary, Peoples Gas Bldg., Chicago, Ill.

National Foreign Trade Council. Fifteenth anniversary convention, Houston, Texas, April 25, 26 and 27. O. K. David, secretary, India House, Hanover Square, New York.

American Society of Mechanical Engineers. Spring Meeting, May 14-16, Pittsburgh, Pa. Calvin W. Rice, secretary, 39 West 39th St., New York City.

American Foundrymen's Association. Convention and Exhibit, Philadelphia, May 14 to 18. Technical Sessions at Hotel Belleview-Stratford; exhibit at Commercial Museum. R. E. Kennedy, secretary, 140 So. Dearborn St., Chicago.

Southern Supply & Machinery Dealers' Association. Will meet in annual convention in Nashville, Tenn., May 15, 16 and 17 jointly with the **National Supply & Distributors' Association** and the **American Supply & Machinery Manufacturers' Association.**

National Association of Purchasing Agents. Annual meeting and "Informashow," Kansas City, Mo., May 28 to 31. W. L. Chandler, secretary, 11 Park Place, New York.

American Railway Association. Schedule of sectional meetings: Division V, Mechanical, June 13 to 20, Atlantic City, N. J.; Division VI, Purchases and Stores, June 13 to 15, Atlantic City, N. J. Division VII, Electrical, Sept. 22 to 28, Cleveland, Ohio. J. W. Welsh, secretary, 292 Madison Avenue, New York City.

Association of Iron and Steel Electrical Engineers. Annual meeting, Stevens Hotel, Chicago, June 25 to 29. J. F. Kelly, managing director, Empire Bldg., Pittsburgh, Pa.

American Society for Testing Materials. Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 25 to 29. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

Society of Automotive Engineers. 1928 Summer Meeting, Chateau Frontenac, Quebec, Canada, June 26 to 29. C. E. Heywood, in charge of meetings, 29 West 39th St., New York.

American Railway Tool Foremen's Association. Annual meeting, Hotel Sherman, Chicago, Sept. 12, 13 and 14. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foreman's Association. Sixteenth annual convention of the Supply Association, Hotel Sherman, Chicago, Sept. 12, 13 and 14. F. A. Armstrong, secretary, the Pratt & Whitney Co., 564 W. Monroe St., Chicago.

National Safety Council. Seventeenth annual safety congress will be held in New York, October 1-5. Idabelle Stevenson, executive secretary, 1 Park Ave., New York.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

QUANTITY differentials on specific steel products, that save the buyer 15 to 40c. per 100 lb., have been adopted at leading warehouses in the New York district. The reductions are confined, however, to orders made up of one or more of the eight steel products mentioned in the accompanying list, no other commodities to be included. The material must also be ordered and released for shipment at one time. Following is the new schedule of prices per 100 lb.:

	Base Price *250 to 3,999 Lb.	4,000 Lb. to 7,999 Lb.	8,000 Lb. to 14,999 Lb.	15,000 Lb. and Over
Bars and bar shapes	*$3.25	$3.10	$3.00	$2.85
Structurals	*3.30	3.15	3.05	2.90
Plates—Tank	*3.30	3.15	3.05	2.90
Plates—Floor	*5.10	4.95	4.85	4.70
Hoops	*4.50	4.35	4.25	4.10
Bands	*4.00	3.85	3.75	3.60
B. A. Sheets	*3.90	3.75	3.65	3.50

*Orders totalling 249 lb. and under will be billed at the same base price as orders for 250 to 3,999 lb. plus an extra of 50c. net per order.

The foregoing prices are f.o.b. New York City, or delivered by truck within trucking limits. The usual extras for cutting, quality and size will apply.

(*All prices as of April* 13)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	16.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.50	3.25	3.90
No. 12	2.15@2.25	3.55	3.30	3.95
No. 14	2.20@2.30	3.60	3.35	4.00
No. 16	2.30@2.40	3.70	3.45	4.10
Black				
Nos. 18 to 20	2.60@2.70	3.75	3.55	4.00
No. 22	2.75@2.85	3.90	3.70	4.15
No. 24	2.80@2.90	3.95	3.75	4.20
No. 26	2.90@3.00	4.05	3.85	4.30
No. 28	3.05@3.15	4.20	4.00	4.45
Galvanized				
No. 10	2.95@3.05	4.10	3.90	4.25
Nos. 12 to 14	3.05@3.15	4.20	4.00	4.35
No. 16	3.15@3.25	4.30	4.10	4.45
No. 18	3.30@3.40	4.45	4.25	4.60
No. 20	3.45@3.55	4.60	4.45	4.75
No. 22	3.50@3.60	4.65	4.50	4.80
No. 24	3.65@3.75	4.80	4.60	4.95
No. 26	3.90@4.00	5.05	4.85	5.20
No. 28	4.15@4.25	5.30	5.10	5.45

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

WROUGHT STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness Decimal	B.w.g. and Fractions	Outside Diameter in Inches ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, 3/16@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			15.00
Tin, straits, pigs, New York			55.00
Lead, pigs, E. St. Louis	6.02½	New York	7.00
Zinc, slabs, E. St. Louis	5.72½	New York	6.75

	New York	Clevelan[d]	Chicago
Antimony, slabs	12.50	13.25	14.25
Copper sheets, base	23.00	23.00	22.75
Copper wire, base	19.50	19.62½	16⅛ (mill)
Copper bars, base	21.50	21.50	22.25
Copper tubing, base	24.50	24.50	24.50
Brass sheets, high, base	18.75	18.75	18.75
Brass tubing, high, base	23.62½	23.62½	23.62½
Brass rods, high, base	16.50	16.50	16.50
Brass wire, high, base	19.25	19.50	19.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25@26*	22¾@24	24.30
Zinc sheets (casks).....	9@ 9½	11.20	10.36
Solder (½ and ½), (case lots).....	34.00	32.50	33@37
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade.....			71.00
Commercial genuine, intermediate grade.....			57.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt (f.o.b.).....			12.00
Nickel, f.o.b. refinery, cents per lb.:			
Ingots..... 35.00	Electrolytic.. 37.00	Shot.....	36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base).....	52.00
Cold rolled nickel sheet (base).....	60.00
Hot rolled rods, Grade "A" (base).....	45.00
Cold drawn rods, Grade "A" (base).....	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot.....	28.00	Hot rolled rods (base)...	35.00
Blocks.....	28.00	Cold drawn rods (base)..	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible copper.....	12.37½@12.62½	11.50	11.25@11.75
Copper, heavy, and wire..	11.50 @12.37½	10.75	10.75@11.25
Copper, light, and bottoms	10.25 @10.75	9.50	9.50@10.00
Heavy lead.....	5.00 @ 5.25	5.25	4.25@ 4.75
Tea lead.....	3.75 @ 4.00	3.75	3.25@ 3.75
Brass, heavy, yellow.....	7.25 @ 7.50	7.25	7.00@ 7.50
Brass, heavy, red.....	9.25 @ 9.75	9.75	9.00@ 9.25
Brass, light.....	5.50 @ 5.75	5.75	6.00@ 6.50
No. 1 yellow rod turnings.	7.50 @ 8.00	7.50	7.00@ 7.50
Zinc.....	3.25 @ 3.50	3.25	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20.....	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20.....	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20.....	6.45	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating—Per box			
IC,	14x20.....	7.75@8.00	5.30	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.‡	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.‡	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.....	.15@.17½	38.00 per M	.15
Sal soda, per lb.....	.02	.02	.02¼
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots.....	.76½	.84	.78
Lard cutting oil, 25% lard, in 5 gal. cans, per gal....	.65	.55	.55
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.....	.30	.36	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.			
Medium grade.....	35%	35%	35%
Heavy grade.....	30%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.			
First grade.....	45%	50–10%	50%*
Second grade.....	50%	60–5%	50–10%†

*Large quantities, 60%. †Large quantities, 60–10% ‡Bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb....	$0.0325	$0.0324	$0.0324
Cold drawn shafting....	per lb....	.034	.034	.04
Brass rods.....	per lb....	.165	.165	.1587½
Solder (½ and ½).....	per lb....	.34	.3325	.42
Cotton waste, white....	per lb....	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia.....	per 100...	3.10	3.10	3.10
Lard cutting oil.....	per gal...	.65	.65	.55
Machine oil.....	per gal...	.30	.30	.33
Belting, leather, medium.....	off list....	35%	35%	40–5%
Machine bolts, up to 1x30 in., full kegs....	off list....	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper.....	$5.40	$4.95	$5.13
*Emery paper.....	10.71	9.15	10.71
†Emery cloth.....	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper.....	1.29	1.27	1.32
Cloth.....	3.10	3.05	3.05
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville, 2.65@3.00		
Coke, prompt foundry, per net ton...	Connellsville, 3.75@4.50		
White lead, dry or in oil...	100 lb. kegs....	New York, 13.75	
Red lead, dry.....	100 lb. kegs....	New York, 13.75	
Red lead, in oil.....	100 lb. kegs....	New York, 15.25	

*4½ reams and under. †Less than 2 reams.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.....	55%
Larger up to 1 x 30-in.....	50%
1¼ and 1¼ in. dia.....	35%
Carriage bolts:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Coach and lag screws:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Tap bolts, hexagonal heads.....	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.....	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.....	55%
Semi-finished, hexagonal, tapped, in packages, all sizes.....	40%
Case hardened, hexagonal, tapped, in packages, all sizes.....	30%
Washers: Deduct from list, per 100 lb.....	$3.50*
Rivets, button and cone head:	
Small, including ⅜-in. dia.....	50–10%
Large (base) per 100 lb. net.....	$5.00†

Note—For less than case or keg quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

La., New Orleans—Engineer Office, War Dept., is receiving bids for a Peir type crane.

Mich., Detroit—Snyder Tool & Engineering Co., 3400 East Lafayette Blvd.—internal girder.

Mich., Detroit — Zima Sign Co., 9117 Joseph Campau Ave.—machinery and equipment including sheet metal brake, shear for cutting angle irons, punch and socket punch, etc. for the manufacture of electric signs.

B. C., Port Alberni — Dept. of Public Works, S. E. O'Brien, Secy., will receive bids until May 8, for a 4 ton electrically operated travelling crane for Assembly wharf, Comon-Alberni District.

Opportunities for Future Business

Calif., Los Angeles—Willys-Overland Co., 2141 Colorado Eagle Rock, manufacturers of automobiles, is having plans prepared for an assembly plant on Randolph St. Estimated cost to exceed $750,000. Austin Co. of California, 777 East Washington St., Engr.

Calif., Pittsburg—H. W. Johns-Manville Co. Inc. of California, 159 New Montgomery St., San Francisco, manufacturers of asbestos products, roofing, etc. had plans prepared for two 1 story, 100 x 500 ft. factory buildings, here. Estimated cost to exceed $1,000,000. H. J. Brunnier, Sharon Bldg., San Francisco, Archt. and Engr.

Calif., San Jose—A. Pratt, c/o Wolfe & Higgins, Realty Bldg., Archts., will soon award contract for the construction of a 1 and 2 story machine shop on 6th St. Noted Mar. 29.

Calif., Santa Clara—Pacific Mfg. Co., is having plans prepared for a 385 x 385 ft. sash and door plant and general woodworking plant. Hamm, Grant & Bruner, Inc., Ferguson Bldg., Los Angeles, Archts.

Conn., Hartford — Connecticut Co., 185 Church St., New Haven, awarded contract for a 1 story, 97 x 130 ft. garage on Vernon St. Estimated cost $60,000. Noted Apr. 5.

Ill., Chicago—Fox & Fox, 38 South Dearborn St., Archts., are receiving bids for a 5 story, 80 x 140 ft. garage at State and 11th Sts. for C. J. Vopicka, 431 North Michigan Ave. Estimated cost $600,000.

Ill., Chicago — Francisco & Jacobs, 511 5th Ave., New York, N. Y., Archts. and Engrs., will receive bids about May 1 for the superstructure of a factory at 35th and Rockwell Sts. here, for Continental Can Co., 100 East 42nd St., New York, N. Y. Estimated cost $1,000,000.

Ill., Chicago—Graham, Anderson, Probst & White, 80 East Jackson Blvd., Archts., had plans prepared for a 3 story, 82 x 502 ft. addition to factory for the manufacture of valves, fittings, etc. at 4100 South Kedzie Ave. for Crane Co., 826 South Michigan Ave.

Ill., Chicago — Halsam Products Co., 4114 Ravenswood Ave., manufacturers of checkers, blocks, etc., awarded contract for rebuilding 3 story, 100 x 125 ft. factory recently destroyed by fire.

Ind., Bloomington—Atlas Plywood Co. is having plans prepared for a factory for the manufacture of boxes for packing furniture. Estimated cost $85,000. Private plans.

Ind., Brazil—Eaglesfield-Link Co. manufacturers of woodworking machinery, is having plans prepared for the construction of a factory. Estimated cost $40,000. Private plans.

Ind., Kendallville—The Electric & Mfg. Co. manufacturers of automatic electric water heaters, is having plans prepared for a factory. Estimated cost $50,000. Private plans.

Ia., Cedar Rapids — W. King, 98 First Ave. W. and T. H. Warriner, 119 Second Ave. E., awarded contract for a 1 story, 93 x 120 and 40 x 47 ft. garage and service station at Second Ave. W. and Second St. Estimated cost $40,000. International Harvester Co., lessee.

Me., Portland—Portland Water Dist., 16 Casco St., will receive until May 7, for a 2 story garage and repair shop. J. C. and J. H. Stevens, 477 Congress St., Archts.

Md., Baltimore — General Electric Co., Bush and Ridgely Sts., will build a 2 story, 20 x 140 ft. addition to factory.

Mass., Cambridge (Boston P. O.)—Cambridge Salvage & Supply Co., Broadway, is having plans prepared for a 1 story, 125 x 150 ft. factory at Charles, Bent and Fifth Sts. Estimated cost $60,000. N. R. Willard, 402 Massachusetts Ave., Arlington, Archt.

Mass., Chicopee—Municipal Light Board, awarded contract for a 3 story, 60 x 70 ft. garage and repair shop, etc. on Front St. Estimated cost $85,000.

Mass., Dorchester (Boston P. O.)—N. E. Jones, 10 Burt St., awarded contract for a 1 story, 90 x 100 ft. repair and service garage on Barnes St. Estimated cost $40,000.

Mass., Medford (Boston P. O.)—Noyes Buick Sales Co., 847 Commonwealth Ave., Boston, will build a 1 story repair shop and service station here. Private plans.

Mass., Waltham—Housing Co., 40 Central St., Boston, will build a 1 story, 50 x 145 ft. addition to builders finish mill, on Waverly St. Private plans.

Mich., Detroit — General Motors Corp., General Motors Bldg., is having plans prepared for a 7 story, 210 x 230 ft. research laboratory on Second Blvd. A. Kahn, 1000 Marquette Bldg., Archt.

Mich., Flint—A. C. Spark Plug Co. will soon award contract for a 3 story addition to factory for porcelain department on South Saginaw St. Estimated cost $40,000. Wright & Nice, 4339 South Saginaw St., Archts.

Mich., Saginaw — General Motors Corp., General Motors Bldg., Detroit, is having plans prepared for 1 and 2 story additions to automobile factory including pattern shop, foundry, cleaning building, etc. here. Estimated cost $1,500,000. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Minn., Albert Lea—Olson Mfg. Co. manufacturers of barn equipment and commercial ventilating systems, is having plans prepared for a 1 story factory. Estimated cost $35,000. Toltz, King Day, Inc., Builders Exchange Bldg., St. Paul, Archts.

Minn., Minneapolis — Griswold Safety Signal Co., F. W. Griswold, Pres., 20 East Hennepin Ave., awarded contract for a 2 story factory at Linden Ave. and 17th St. N. Estimated cost $40,000. Lang, Raugland & Lewis, 412 Essex Bldg., Archts.

Minn., Rochester—International Harvester Co. is having plans prepared for a 1 story, 101 x 110 ft. implement warehouse and shop building. Estimated cost $35,000. Lester Implement Co., lessee.

Mo., St. Louis—Century Electric Co., Inc., 1806 Pine St., will soon receive bids for a 1 story foundry at 3739 Market St. Estimated cost $200,000. Klipstein & Rathmann, Security National Bank Bldg., Archts.

Mo., Kansas City—Capitol Garage, Inc., H. Rubin, Pres., 4208 Harrison St., plans the construction of a 7 story, 123 x 130 ft. garage. Estimated cost $150,000. Private plans.

Neb., Hastings — Hastings Casket Co., F. A. Mitchell, Secy., is having plans prepared for a 2 story casket factory. M. L. Evans, Brandes Bldg., Hastings, Archt.

N. J., Camden—S. M. Langston Co., 6th and Jefferson Sts., manufacturers of paper box machinery, awarded contract for a 1 story, 40 x 95 ft. factory at 1927 South 6th St.

N. J., Harrison—Otis Elevator Co., 11th Ave. and 26th St., New York, awarded contract for a 1 and 2 story, 250 x 450 ft. cab shop here. Estimated cost $500,000.

N. Y., Brooklyn—Bureau of Yards & Docks, Navy Dept., Washington, D. C., will soon awarded contract for the construction of a garage at Navy Yard here.

N. Y., Brooklyn—M. F. Doody, 1438 East 12th St., had plans prepared for a 94 x 104 ft. garage at Coney Island Ave. and Ave. P. Estimated cost $70,000. Seelig & Finkelstein, 44 Court St., Archts.

N. Y., Brooklyn—S. and A. Ragonesi, 2063 61st St., had plans prepared for a 100 x 108 ft. garage at Gravesend Ave. and Ave. M. Estimated cost $50,000. F. F. Paunaman, 26 Court St., Archt.

N. Y., Flushing—Prisco & Soriero Inc., 9073 Sutphin Blvd., Jamaica, had plans prepared for a 1 story, 49 x 298 ft. garage at Northern Blvd. and 159th St. Estimated cost $100,000. W. C. Winters, 2772 Fulton St., Brooklyn, Archt.

N. Y., New York—Billbuck Construction Co., W. Buedley, Pres., 2241 Creston Ave., will build a 100 x 208 ft. garage at Broone Ave. and 174th St. Estimated cost $40,000. J. J. Dunnigan, 2382 Grand Concourse, Archt.

N. Y., New York—Rosella Building Corp., D. La Ialle, Pres., 2013 Jerome Ave., will build a 2 story, 100 x 120 ft. garage at Carter and Webster Aves. and 176th St. Estimated cost $75,000. L. Pisciotta, 563 Tremont Ave., Archt.

N. D., Grand Forks — Great Northern Railway Co., Railroad Bldg., St. Paul, Minn., will soon receive bids for a 1 story, 90 x 250 ft. machine shop and engine room, here. T. D. McMahon, 1208 Railroad Bldg., St. Paul, Archt.

O., Bedford — Aluminum Bronze Powder Co., P. J. Steigerwald, 1823 Columbus Rd., Cleveland, awarded contract for a 1 story, 36 x 80 ft. factory, here. Estimated cost $40,000.

O., Youngstown—Carnegie Steel Co. will soon receive bids for the construction of a steel mill at McDonald St. Estimated cost $500,000.

Okla., Guthrie—Athison, Topeka & Santa Fe Ry., 80 East Jackson Blvd., Chicago, Ill., awarded contract for a 1 story, 42 x 147 ft. machine shop here. Estimated cost $60,000. H. W. Wagner, Topeka, Kan., Engr. (Eastern Lines). Noted Mar. 1.

Pa., New Castle — The Shenango Motor Co. awarded contract for a 2 story, 100 x 150 ft. garage. Estimated cost $200,000. Noted Mar. 22.

Pa., Philadelphia — Goldfine Bros., 350 North Second St., awarded contract for a 2 story, 72 x 200 and 45 x 64 ft. garage at 342 North Second St. Estimated cost $180,000. Noted Mar. 15.

Pa., Philadelphia — Philadelphia Rapid Transit Co., Broad and Locust Sts., will soon award contract for a 1 story, 80 x 400 ft. bus repair shop at Third and Hunting Park Ave. Private plans.

R. I., Pawtucket—Collyer Insulated Wire Co., 249 North Main St., will soon award contract for a 3 story, 80 x 106 ft. factory on North Main St. Estimated cost $100,000. Monahan & Miekle, 255 Main St., Archts.

Wis., Milwaukee—Badger Meter Co., 841 30th St., plans a 1 and 2 story, 60 x 120 ft. addition to foundry and carpenter shop on Milwaukee Ave. M. Tullgren & Sons, 20 Prospect Ave., Archts.

B. C., Vancouver—Bd. of School Trustees awarded contract for a 4 story technical school including 133 x 283 ft. work shop, etc. at Broadway E. and Clinton St. Estimated cost $500,000. Noted Apr. 12.

Que., Montreal—Canadian National Railways, New Union Station, Toronto, Ont., will soon award contract for the construction of Pointe St. Charles shops, here. T. T. Irving, Ch. Regional Engr.